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New England Association of Gas Engineers.

OPENING OF THE MEETING.

The semi-annual meeting of the New England Association of Gas Engineers for the year 1875 was held in Lyceum Hall, Providence, R. I., on the 18th day of August last. There were about twenty-six members present. Several gentlemen, representing gas companies from other parts of the country attended by invitation.

The president, George D. Cabot, Esq., occupied the chair, and at the opening of the session made a short address stating the object of the meeting, extending a welcome to the members and others who were present, and assuring them that he should do all in his power, as presiding officer, to make the meeting both pleasant and profitable.

The reading of the record being in the order of next proceeding, the secretary stated that he had sent copies of the AMERICAN GAS-LIGHT JOURNAL, containing said record in full, to all the members of the Association who were not subscribers to that paper, thus giving them an opportunity to peruse an account of the procedings at their leisure. He also stated that the record covered some fourteen pages of his minute book.

Voted, that for the reasons given by the secretary, the reading of the record be dispensed with, and that the same be approved.

A letter was received from Mr. Corliss inviting the association and guests to visit the works of the Corliss Engine Company at such time as should be most convenient.

Voted to accept the invitation with thanks. The forenoon of the following day was fixed for the visit.

A letter from Mr. J. P. Harbison was read by the secretary, expressing his regret at not being able to be present at the meeting, as he was then about to leave for a trip to Europe, and wishing, in conclusion, for the Association a successful meeting.

LIME PURIFICATION.

An important letter from Mr. Gerdenier was also read, in which he gave some interesting facts and figures relative to his experiments with lime purification, suggested by the paper on that subject read by Mr. Forstall of New Orleans, at the last meeting of the American Gas-Light Association, which showed a very great improvement in purification, and a great saving of material and labor.

Voted that the above communication be placed on file.

The reading of the letter from Mr. Gerdenier led to a long discussion on the peculiar merits of Mr. Forstall's method of purification, from which it appeared that many of the members present, acting upon the suggestions contained in the paper referred to, had adopted in whole or in part that method, with good results.

COAL TAR.

The next subject taken up for discussion was the expediency, practicability, and economy of the use of coal tar as fuel, for heating retorts.

Mr. Lamson, superintendent of the Boston Gas Works, where the experiment has been going on for some time past on a large scale, being called upon, gave a very interesting description of the process employed by him, a statement of the relative cost of tar as compared with coke for such purposes, and also his opinion as to its economy and efficiency. This was favorable, although he wished it to be understood that his statements and opinions were not conclusive, his experiments not having, as yet, been so thorough or extended as to warrant a final decision on the merits of the peculiar process under consideration.

A short adjournment now took place, after which the discussion of the subject of the use of tar for fuel was resumed, and participated in by many of the members in a more or less informal manner.

USE OF COKE.

By a natural transition the Association passed to the consideration of the question whether there were not some methods in use, by which coke for heating retorts could be rendered more available and more economical, by improved settings of benches. Among many methods mentioned was that recommended by Mr. Cathels of Montreal, who claims to make a very great saving of coke by using his peculiar plan of settings. The percentage of coke used in each bench as compared with the quantity manufactured in the same bench according to statements given by many present, appeared to differ very widely in different works, some showing an incredibly small proportion and some a quite large one, reaching in some instances to sixty per cent. This discrepancy must be caused by the use of different coals, or from carrying greater heats, or from inaccuracy in some cases in measurement.

It seemed, however, to be the opinion of those who took part in the discussion, that it is the imperative duty of the manufacturer of gas to adopt methods whereby the cost of the production of that essential article of use may be reduced to the lowest figure, that thus the manufacturer may be enabled to dispose of the same at a moderate price, whilst realizing reasonable profit for the risk incurred, and the capital employed.

NAPHTHALINE.

The next topic presented for consideration was naphthaline—its cause and remedy. From statements made during the discussion, it appeared that a large proportion of the companies are now, or have been troubled, more or less, by this "abominable pest," which manifests its presence in the gas by stoppage in the inlet or outlet pipes of the holders, in the mains and services in the street lamps, and sometimes in the meters and fixtures in buildings. The question of interest therefore is, what preventive can be used, or what remedy can be applied?

Many causes were assigned and many remedies suggested; but there seemed to be no agreement in opinion among the members. All however agreed in this, that a generous use of Albert coal, or of the richest in quality of Cannel was more likely than any thing else to prevent the deposit of naphthaline, and to retain it until it reached the burner, where it could be beneficially used in improving the candle power of the gas.

Any one who will discover a simple, inexpensive, and sure cure for the evil, will be entitled to the warmest thanks of all gas engineers of companies suffering from this infliction.

AMMONIA.

The next topic introduced was ammonia, and how it may be removed without detriment to the gas. Remarks were made and facts presented by a few of the members: but the time being limited no satisfactory conclusion was arrived at, and the subject was left open, to be treated more fully at a future time.

REDUCTION IN PRICE.

The adoption of the practice by many large manufacturing and business establishments, in various localities, of furnishing themselves with gas for illuminating purposes from their own works, thereby seriously affecting the business of regular gas companies, was then alluded to, and the question was very seriously put, whether it is possible or probable that the cost of producing gas can be reduced so as to regain, or at least retain the business which has been, or may be lost in the way just stated. No feasible plan seems at present to be available to counteract the evil, as gas companies are obliged to fix a price sufficiently large to cover, not only the cost of manufacture, but also the cost of distribution, with all incidental expenses for repairs, etc. Over and above all this, a sufficient margin must be reserved to allow a fair percentage of profit on the capital invested.

With private establishments the only item of expense which seems to be taken into account is that of material carbonized, while the expense of wear and tear and renewal, the interest on the cost of works and machinery, and in many instances, the wages paid to workmen are wholly ignored. It was quite refreshing and encouraging to learn, from some of the members present, that instances had come under their observation, where private gas works had been abandoned, and gas from the public source had been again resorted to. In treating of the subject, the naphtha question received some little attention,

but no great interest was manifested. Many companies which once adopted various naphtha processes, with the most sanguine expectations have, one after the other, abandoned them; in many cases without assigning any satisfactory reasons for so doing.

Mr. Yorke, who has lately made an attempt to manufacture naphtha gas in connection with coal gas, explained to the meeting the method employed by him and the results obtained. These results, he remarked, were so unsatisfactory, that the whole naphtha process was abandoned by him.

It seemed to be the opinion of the members of the Association, that the expectations of those who have tried the experiment of producing naphtha gas for general illuminating purposes, except, perhaps in a few rare and exceptional instances, have not been realized, and that further time and much care, thought, and patience must be expended before satisfactory results can be obtained.

MISCELLANEOUS.

The last topic considered, before adjournment, was the expediency and the duty of managers of gas companies, after ascertaining by experiment or otherwise, what is the most economical and best burner to be used for illuminating purposes by their respective consumers, to recommend the same for that purpose. One of the speakers stated that it had been his practice for some time, not only to recommend but also to provide burners for his consumers, suited to the gas furnished by his company, charging a reasonable price therefor.

Mr. C. S. Coldbach, of North Attleboro, having been nominated by Mr. Rogers of Jamaica, he was unanimously elected a member of the Association.

In consequence of the intense heat, the evening session arranged for in the programme was dispensed with.

Mr. Slater, in behalf of the Providence Gas-Light Company, extended an invitation to the Association and guests, to meet at 8½ o'clock on the following morning in front of the Aldrich House, where conveyances would be found ready to take the party to the gas works, and other points of interest about the city, and then to the boat for Maxfields Silver Spring, where a clam bake would be provided.

The meeting adjourned *sine die*.

Purification of Gas by Oxide of Iron.

At the general meeting of the *Societe Technique de L'Industrie du Gaz en France*, recently held in Paris, an interesting paper was read by the president, M A. Mallet, on "The Theory of the Purification of Gas by Oxide of Iron. The following is a translation of the essential parts:

All those who are occupied in the manufacture of gas are aware that oxide of iron is employed in purification, for the purpose of absorbing the sulphuretted hydrogen. In France the oxide of iron generally employed is that obtained by treating protosulphate of iron (green vitriol) with hydrated lime.

By this treatment hydrated protoxide of iron is produced, which is of a greenish-black color, and on contact with air quickly passes into the state of sesquioxide, which is only a mixture of protoxide and peroxide of iron. The lime combines with the sulphuric acid, forming sulphate of lime, sawdust also being generally employed to divide the oxide of iron, and render the mixture more permeable to the gas.

The action of the sulphuretted hydrogen contained in the gas has not, up to the present time, as far as I am aware, given rise to any controversy. It is admitted on all sides that the hydrogen of a part of the hydrosulphuric acid combines with a part of the oxygen of the sesquioxide, which is thus brought back to the state of protoxide, sulphur being deposited.

The protoxide of iron, both that proceeding from the reduction of the peroxide and that pre-existing in the sesquioxide, combines with another portion of the sulphuretted hydrogen of the gas, producing sulphide of iron, which is hydrated.

As the gas, on its arrival in the purifying vessels holding the oxide of iron, mostly contains ammoniacal salts, and especially carbonate of ammonia, there is formed, by double decomposition, sulphate of ammonia and carbonate of lime.

When the oxide of iron purifying material is withdrawn from the purifiers, it is exposed to the atmosphere, when a reaction, due to the presence of oxygen, takes place; the material changes from the black color due to the hydrated sulphide of iron to the red color, and is then able to perform again its purifying functions, revivification having been effected.

What chemical reaction takes place in this revivification? It is here that disagreement begins, as much among theoretical as among practical chemists. Some of these gentlemen, and among them is M. Dumas, admit that the hydrated sulphide of iron produces sulphur and oxide of iron; others think that only a part of the sulphur undergoes this transformation, and that the other part passes into the state of protosulphide of iron. M. Cahours goes farther than that. He says, in his "Treatise on Chemistry," that the whole of the sulphur passes into the state of sulphate. Clegg, in his "Treatise on Coal Gas," admits that a small part of the sulphur is transformed into sulphate, especially when the gas contains ammonia. In support of both hypotheses more or less conclusive reasons might be adduced; but, as a solution of the question may be arrived at by direct experiments, I have thought it more simple to have recourse to them.

Two modes of proceeding present themselves to view, in order to arrive at this solution.

We can submit to the action of the gas some oxide of iron purifying material, prepared in the ordinary way, taking care first to ascertain the quantity of sulphuric acid it contains; then ascertain the quantity of free acid contained in the material after it has purified a tolerably large volume of gas. If the quantity of salphuric acid has not augmented, it is because in revivification all the sulphide of iron has been transformed into sulphur and oxide of iron; if the quantity of sulphuric acid has augmented, it is because sulphur, in a larger or smaller quantity, has passed into the state of sulphate.

The other method is more simple—in this sense, that it does not require any test to be made for sulphuric acid. If in this condition oxide of iron that has served for the purification of gas and been revivified does not contain sulphuric acid, it is because no sulphate has been formed during revivification.

This is the plan I adopted. Into a solution of the chloride of iron of commerce I poured a solution of chloride of barium until precipitation would no longer take place. I then treated the solution, filtered from sulphate of baryta, with pure carbonate of soda.

The precipitate obtained, which was simply oxide or carbonate of iron, contained, therefore, no sulphuric acid. I then mixed it with sawdust, and placed it in a small experimental purifier, through which, for several days, gas coming direct from an ordinary gas-works, and consequently containing ammonia, had been passing. This material was several times revivified.

The liquor obtained by the washing of the revivified purifying material with the distilled water gave, on the addition of chloride of barium, a copious precipitate of carbonate of baryta, consequent upon the presence of carbonate of ammonia in the purifying material.

This precipitate was treated with water acidulated with nitric acid, and submitted to a temperature approaching 1000° Cent. Under this action it was entirely dissolved, whence I am led to believe that it contained no sulphate of baryta, and that no sulphuric acid had been formed in the act of revivification; but the addition of the acid gave rise to a liberation of gas, the odor of which disclosed the presence of sulphurous acid. I ought to remark that sulphurous acid combined with a base may be transformed into sulphuric acid on contact with the air, especially in the presence of moisture.

This sulphurous acid may have been produced by the distillation of coal, an operation which in certain conditions is capable also of engendering sulphuric acid; but sulphate of ammonia being a salt that is tolerably soluble, and of but slight volatility, it ought, according to my view, to precipitate during condensation, and be dissolved when the gas is submitted to the operation of washing in the scrubbers.

Sulphite of ammonia is more volatile, and is capable of offering greater resistance to condensation and washing.

In the case in point the condensation was very good, the gas was submitted to a double washing, first with ammoniacal liquor, afterwards with clear water The sulphate of ammonia which might have been produced during the manufacture of the gas should have been condensed, and the result of the analysis shows that such, in fact was the case; but the sulphite of ammonia remained—a conclusion to which I am led from the liberation of sulphurous acid.

From my experience I think I may conclude that the revivification of the oxide of iron does not produce sulphuric acid; and that if any of this acid should be found in material that has served for purification, it is because it proceeds from the distillation of the coal, or else is due to the action of the oxygen in the air upon the sulphite or ammonia that the gas has brought with it.

As will be seen, the solution of the problem is not so simple as at first sight it appears, and necessitates long and connected researches. It is my intention to continue this study, and to communicate to you on another occasion the results obtained, if they should be found to be worthy of your attention.

Gas from Gasoline.

BY PROF. C. O. THOMPSON.

Some interesting problems were presented in a recent investigation of the manufacture of illuminating gas from gasoline, undertaken in behalf of the Congregational Society of Warren, Mass.

It seems that when the Excelsior Gas Machine Company, who make gas from gasoline, opened works at Warren in 1871, the society obtained special permission from the insurance companies who had written policies on their meeting-house, to use "*gas*" for lighting the audience room. The use of "*gasoline*" was explicitly prohibited in the declarations of the policies.

In accordance with this special clause, gas from the Excelsior machine was carried into the house, and used in the usual way.

On the 29th of April, 1874, from some cause not yet ascertained with any certainty, an explosion occurred in the basement, followed by a fire, which consumed the building and its contents.

One of the insurance companies resisted the claim of the society for indemnity, on the ground that the explosion was due to gasoline, a substance unlawfully used, and that the so-called "gas" from the Excelsior machine was nothing but gasoline mixed with air.

That this explanation is not valid, and that the gas used by the society was illuminating gas in the ordinary acceptation of the term, were shown by certain experiments.

In the Excelsior machine gasoline, sp. gr. to ·705, is drawn, by gravitation, from a tank at some distance from the machine, through a pipe furnished with a stopcock, in an iron retort. The retort is heated by Bunsen burners. When the retort is hot, the cock is opened, gasoline enters, and is instantly volatilized. As my experiments show, a part of the gasoline is split up into a "fixed gas" and a vapor of a hydrocarbon heavier than the gasoline used. The gas and vapor thus generated, having as yet no immediate outlet, accumulate under an increasing pressure, and force the stream of liquid gasoline further and further back, in the supply pipe towards the tank. It is obvious that the pipe will have a temperature for several feet next the retort, while the machine is in use, much higher than the boiling point of gasoline, 86°F., and that, after the retort is fully heated, no *liquid* gasoline can enter it.

From the retort a delivery tube is carried, through a Giffard injector which furnishes a percentage of air to the passing gas, to a gasometer. The gasometer is relatively quite small, the design being to keep the gas under pressure in the retort.

It is evident that this intermittent action of the gasometer keeps the vapor of gasoline under a high temperature for a considerable time, often more than a minute, so that a larger part of its lighter ingredients are broken up by the heat than there would be if the vapor merely passed through the retort *en route* to the gasometer.

As the gasometer descends into a well of water, it opens a valve in the delivery tube of the retort, and is quickly filled, closing the valve as it rises. The Bunsens under the retort are fed from the general supply-pipe, which runs from the gasometer. If, by any mishap, the Bunsens should be extinguished, and, in consequence, the retort filled with the liquid gasoline, an automatic cut-off prevents this liquid from passing over into the gasometer. To determine the effect of the hot retort upon gasoline vapor under these circumstances, some gas was drawn from a faucet, just as it was used in the town. An analysis of this, made by Prof. Kimball, shows its nature:

Air	70 per cent.
Fixed gas, hydrocarbons homologous with marsh gas	27 "
Olefiant gas	1 "
Probably hydrogen	2 "
	100

No carbonic acid or carbonic oxide.

Tension of the vapor of the gasoline used—

12½°C.	280mm.
17¾°C.	320mm.
20° C.	360mm.
22½°C.	400mm.

This gaseous mixture carries in solution the vapor of the volatile hydrocarbons from which it is generated, but is far from being saturated with them. The *main* differences between this gas and common "street gas" are—(1) that in one the principal diluent is air, in the other hydrogen; and (2) that the dissolved vapors in "street gas" are not of the marsh gas series.

Again, the air was cut off from the injector, in experiments repeated under varying conditions of temperature, and the gas drawn directly from the retort. This was found to contain varying percentages of fixed gas; that is, gas not convertible into liquid at 0°C., mixed with a little air which came in through the joints.

Several experiments were made upon a machine now in use in the town of Warren. The air was cut off, and gas drawn directly from the retort into a clean glass flask, immersed in ice-water, and furnished with a delivery tube. A hydrocarbon liquid condensed in the flask, and a flame of diminishing luminosity every way like marsh gas was lighted at the end of the delivery tube. The drip was, in every case, heavier than the *gasoline used in making it* (for the specific gravity of gasoline is not constant. Further, as compared with the gasoline, the rates of evaporation varied. Thus, three samples of drip taken April 26, 1875, compared with their source, stood thus:

	Gasoline.	Drip No 1	Drip No 2	Drip No 3.
Specific gravity	·642	·654	·658	·668
Rate of evaporation	16	13	10	

It appears, therefore, that, whenever a mixture of hydrocarbon vapors of different specific gravities is exposed to a high temperature, the lighter ones are broken up first. This result was confirmed by a series of laboratory experiments, which disclosed the fact that gasoline, distilled in small quantities, is completely broken up at a temperature below +400°F., while kerosene at that temperature passes over unchanged.

The apparatus used for these experiments was, in brief, a tank delivering gasoline upon loosening a nipper tap, by gravity into a test-tube inclosed in a hot air chamber, whose temperature was under control and observation. From the test-tube a delivery tube leads to a small two-necked bottle, and from this another delivery to a similar bottle. From the last rises a long delivery tube, terminating in a jet. At a temperature of 400° F., the gasoline vapor began to split up, and a characteristic marsh gas flame, slightly luminous, was lighted at the jet. Below 400°F., gasoline was wholly broken up, and a viscid, tarry deposit appeared in the test-tube.

Air was completely excluded from the apparatus. To connect these experiments with the phenomena of the Excelsior Gas Machine, it is sufficient to observe that the temperature of the retort is a little below the red-heat of iron.—*Am. Chemist.*

Natural Gas in the Manufacture of Iron.

It is really astonishing to observe the extent to which the utilization of natural gas as a substitute for other fuel is being carried in the neighborhood of Pittsburgh. From the last *American Manufacturer* we copy the following items of information on this very interesting subject;

Some ten years ago a well was bored near Beaver Falls for salt water, and for a time salt was manufactured from the brine obtained; but it was finally concluded to sink the well several hundred feet deeper, in doing which gas was struck, which threw the drilling tools into the air. The well was then abandoned, and gas has been flowing ever since. In May last three gentlemen sunk the well to a depth of 1100 feet and found gas in great quantity, which they intend to bring to such of the factories in Beaver Falls as desire to use it. A pipe was laid to the file factory on the 4th inst., and the gas introduced into the furnace, where it proved successful beyond expectation, for tempering. It is the intention to use it for all heating purposes in this factory. It required 65,000 feet of pipe from the well to the factory, at a cost of about $2,000. They claim to have ninety pounds pressure to the square inch. The gas can be furnished much cheaper than coal, and it is said to be far superior for tempering.

We have frequently made mention of the gas well which Spang, Chalfant & Co. commenced to bore some months ago. It may be remembered that in March last the tools were lost, at a depth of some 2000 feet, by the breaking of the coupling, and all efforts to get them have thus far failed. They have now commenced to ream off the top of the coupling, which will enable them to grapple the tools and pull them out, when boring will be resumed. Gas has already been found, and apparently in considerable quantity, from the fact that it frequently throws the water higher than the derrick. The well has been christened "Bessy Turner."

Graff, Bennett & Co., and Spang, Chalfant & Co. havs struck the first blow toward bringing the gas of the big well in Butler county to their mills. Work on the trenches for the pipe was commenced on Monday, and the contract stipulates that the pipe must be laid within twenty five days. The trench is to be three feet deep, and the pipe six inches in diameter, and about seventeen miles in length. If the attempt proves successful, of which there would seem to be no doubt, it will induce other movements of the kind, and thus a marked era in iron making in Pittsburgh will be ushered in.

Jones, Ingold & Co., at their steel works, near McKeesport, are boring for gas. The well is now down nearly 1100 feet, and more than one current has been met, but not in sufficient quantity to meet their purpose; and on this account they are still boring.

At Cleveland the new fuel is also receiving attention. The *Trade Review* remarks as follows: The gas well at the works of the American Boiler Plate Company has attained a depth of 1,305 feet, and a gas pressure of 61 lbs. to the inch, and is now regarded as satisfactory. Other wells will undoubtedly follow this one, at other works.—*Bulletin I. and S. Association.*

The Magnetization of Gas Spectra.

Some very curious experiments have recently been laid before the French Academy of Sciences by M. Chautard, relative to the influence of a powerful magnet upon the spectra of gases contained in Geissler tubes, and illuminated by means of the electric current. In all simple bodies of the chlorine family, and in the gaseous or volatile compounds derived therefrom, which have thus far been examined, the action of the magnet is immediate, and manifests itself, not merely by a change of color in the tube, but by an increased brilliancy of the spectral lines, which become doubled. The bodies thus far submitted to investigation, besides chlorine, which behave similarly, include bromine, iodine, the chloride, bromide and fluoride of silicium, the fluoride of boron, hydrochloric acid, chloride of antimony and of bismuth, bichloride of mercury, and the protochloride and bichloride of tin.

The lights of sulphur and of selenium become extinguished the instant the magnet is excited, and the same is the case with that of the tubes containing chlorine, bromine, and iodine when the tension of the coil is suitable. The feeble brilliancy of the oxygen illumination is not sensibly modified, nor is that of carbon compounds, such as carbonic acid, carbonic oxide, etc. The fine bands of the nitrogen spectrum are not changed, except in the red and yellow portion. These colors become almost entirely extinguished, or at least are replaced by a flat uniform tint, in which all traces of lines disappear. The lines in the more refrangible portion remain intact.

The hydrogen lines keep sensibly their normal appearance, but by employing a sufficiently powerful magnet, at the moment of excitation a very brilliant yellow line appears, which is due to sodium, doubtless obtained from the surrounding glass. This line vanishes as if by magic when the current is interrupted, to reappear again, however, for some time, as often as the electric flow is established. Eventually it loses intensity, and it becomes necessary to allow the tube several minutes of repose before the line can again be caused to appear. It shows itself also in nitrogen tubes, and in those containing carbonic and hydrochloric acid.

The protochloride of tin, crystallized and dry, but bihydrated, offers remarkable phenomena of dissociation under the magnetic influence. Normally the spectrum is pale, and shows a few of the green chlorine lines; but as soon as the magnet is excited, two characteristic bands of hydrogen, the red and blue, appear, which remain as long as the magnetization exists, and return with the same indefinitely. M. Chautard attributes this to the momentary separation of the elements of the water of the salt, due to the considerable resistance opposed to the passage of the induced current during the magnetization.

M. Chautards's investigations are still in progress, and doubtless further novel and interesting results remain to be adduced. The phenomena noted are remarkable, and will attract the close attention of chemists and physicists generally.—*Sci. American.*

House Ventilation and Warming.

The last number of the *Westminster Review* contained an excellent article on "House Ventilation and Warming." A few extracts will be acceptable and useful. After urging the importance of the subject, the writer lays down the following

RULES FOR VENTILATION.

"The first rule therefore to be laid down in reference to perfect ventilation prescribes the entire removal of the whole *stratum* of air tainted in a room by each respiration; for by no less a movement do we conceive it possible to take away the polluted air. This removal must be effected no less than twenty times per minute. Part of the expired air being rarified by the heat of the lungs will rise, and part (the carbonic acid gas) will fall. Twenty-four cubic inches, thus spread, may be assumed to taint a stratum at or about a mouth of an occupant of eighteen inches.

Any lateral movement would, in the case of several occupants, simply sweep the air breathed by one person close by the lips of some ether; and hence we hold, as a collary to this rule. that the prescribed movement should be either up or down, not lateral.

"But the preceding calculation is based upon the minimum consumption of each person during quiescence. When talking, laughing, singing, walking, or dancing, the average respirattons are, relatively quickened, the consumption of air increased, and the necessity for a rapid change of atmosphere further enhanced. The amount of air inspired has been found to be as lollows:

When lying down (say)	1·00
" sitting	1·18
" standing	1·33
" singing	1·16
" walking 1 mile per hour	1·90
" " 2 miles "	2·76
" " 3 " "	3·22
" " 3 " " and carrying 34 lbs.	3·50
" " 4 miles "	5·00
" " 6 " "	7·00
" riding (trotting) "	4·05
" swimming "	4·33

"The above ascertained accelerations of the respiratory organs sufficiently indicate the effect produced by all kinds of in-door exertion, and incontestably prove, from increased demand, the necessity for increased supply.

"This view, which we admit to be an extreme one, of ventilation requirements in dwelling-houses, may serve, at least, to impress upon many the advantage of living as much as possible out of doors, and of taking some regular exercise. On the other hand, it will certainly show the futility of the petty, peddling expedients adopted under the name of ventilation, when the prevailing apathy is stirred to such an extent as to cause "something to be done," which may be a little better than resting content with doing nothing at an."

"The second rule that we lay down, relates to the conditions of the supply of the large volume of fresh air we have indicated as necessary for perfect health; it must be tempered—warmed. No raw, damp, frosty air of an ever-changing temperature ought to have uncontrolled and constant ingress to our dwellings. Air out of doors is suited to out-of-door habits. It is healthy and bracing when the body is coated and wrapped, and prepared to meet it. and when exercise can be taken to keep up the circulation; but to live under cover is to live artificially, and all essential conditions must be dealt with to suit an abnormal state, and all the evils attaching to ventilation, as generally effected, spring from the neglect of this consistency. We admit raw air, and we warm it most at the critical moment when we send it up the chimney! We freeze our backs and scorch our faces. We sit with our feet in a current of cold air, and our heads are kept in an impure atmosphere, vitiated by human lungs, the products of gas consumption, and loaded with animal matter. We have a torrid zone bordered by the hearth-rug, and the arctic regions in the neighborhood of the windows and door. Medical men shiver at the abstract idea of violent changes of temperature, but they raise no warning voice against delicate patients being subjected to a variation of 60° in a modern drawing-room. The notion is stereotyped that night air is unwholesome. The casual admission of air during the day is no longer permitted, all known apertures are carefully closed, and, if intention could be realized, not an atom of fresh air would be admitted during the hours of sleep. So little is the necessity for good air understood, that we find an able writer on health sanctioning, if not advocating, sleeping with the mouth under the clothes. His argument is that birds sleep with heads under their wings, and he might have added, many animals with their noses buried in their fur; forgetful, however, that the feathers and hair form a natural respirator to *warm and equalize the temperature* of the air that passes freely through. There is therefore no analogy in a process for warming a constant supply of perfectly fresh air, and one for breathing the same air over and over again, and charged *ad nauseam* with organic impurities."

Gas-Light Intelligence.

United States.

The personal property of the Long Island City Gas Company was sold on Friday, 24th ult., at public auction, for $10,750. On Tuesday last the works were to be sold at Sheriff's sale, for non-payment of interest upon $25,000 bonds issued by the company when organized.

The gas-lighting arrangements of the New York Post Office have not yet been completed. A number of alterations are being made in the original plans, in order to ensure the most perfect light. It is at present uncertain what plan will be finally adopted; and in consequence of this we have been requested to withbold a description of the gas apparatus of the office which was intended for this issue. When the work is completed, a full and reliable account of the whole thing will be furnished, which will contain many features of interest.

Mr. W. G. Barrett, Cashier of the San Francisco Gas-Light Company has been made the happy recipient of a testimonial from his associates in the company on the completion of a fifteen years' period of service. The testimonial consisted of an elegant service of silver plate, and was accompanied by a flattering address, bearing the signatures of a large number of the subscribers. The presentation, which took place in the office of the company, was made the occasion of a pleasant social meeting, at which a number of appropriate speeches were delivered.

Two instances have just occurred illustrative of the danger of kerosene, and the advantage of using gas. At Tompkinsville, on the 23d ult., the dwelling-house of Mr. J. Secrestor was set on fire by the explosion of a kerosene lamp; and at Little Falls, New Jersey on the morning 24th ult., the woollen mill of Geo. Jackson was burned down through the breaking of a kerosene lamp, and loss occasioned to the amount of $40,000. Would such accidents have occurred had gas been used?

The National Tube Works Company, Philadelphia, has just completed the pioneer gas-pipe line for bringing gas from the gas wells in Butler County, Pennsylvania, to Pittsburg, Pa., to be used in their iron-furnaces. It is made of lap-welded wrought-iron pipe, six inches in diameter, and about thirty miles long. Connections will soon be made for running the gas, which is "natural," through the pipe; and it will undoubtedly open up a new and extensive field in the use of gas for manufacturing purposes.

A correspondent furnishes the following result of a day's use in the Springfield, Illinois, gas works, of Alfred Odiorne's seal for hydraulic mains:

"The Springfield, Ill., Gas Company, at this dull season, works only 5 benches of retorts (clay, threes, 14+22—8 ft. 6 in. long) and uses a poor quality of gas coal mined near the works, which yields only $3\frac{1}{4}$ feet per pound. These five benches made September 3d, 74,000 feet of gas in 24 hours, being about their average yield. Two of them have been in constant use 26 months, two 18 months, and one 13 months. *The carbon has never been removed from either of them*, the accumulation having been prevented by the use of the above-mentioned seal, which is described in the GAS-LIGHT JOURNAL of July 17, 1871. To practical gas makers comment is unnecessary. A copy of the description referred to will be sent to any gas-light company, on application to A. Odiorne, Springfield, Illinois.

A series of experiments have recently been conducted in the manufacture and use of water-gas, in the city of Brooklyn. The experiments were carefully made, and were considered moderately successful.

Great Britain.

A dividend of 10 per cent. has been declared by the Wakefield Gas Company.

A reduction of 3d. per 1000 cubic feet has been made by the South Shields Gas Company.

The Sunderland Gas Company are authorized to raise by shares an additional £20,000, for the purposes of extension.

The Wrexham Gas Company has just paid a dividend for the year of £3.—15 per cent.

The value of the gas stock of the Annan Gas-Light Company may be judged of when it is mentioned that five shares were sold privately a few days ago at £9 per share, the original cost being only £5 per share.

It has been resolved by the directors of the Moffat Gas Company to reduce the price of gas from 8s. 4d. to 7s. 6d. per 1000 cubic feet, as from Sept. 1. This is the second reduction since the beginning of the present year, prior to which the price was 10s. per 1000 feet.

The Longton corporation has agreed to purchase the gas works as town property.

Mr. Breadhead of the Great Grimsby Gas Works having been compelled to resign his duties as manager, through ill-health, the company have made him a present of £100, and appointed him assistant engineer at a salary of £50 per annum. The clerks and workmen also have presented Mr. Broadhead with a piece of plate, consisting of a hot water kettle and salver, bearing an appropriate inreription.

A new gas company has been formed at St.-Annes-on-the-Sea, Lytham, with a capital of £15,000 in £5 shares.

A company has been registered, with a capital of £40,000 in £5 shares, to acquire patent No. 1922 of 1869, granted to Mr. H. F. A. Duckham, for the invention of improvements in gas regulators; also a patent for improvement in gas regulators, and the combined pneumatic machine and compressed gas regulator. The consideration is £20,000, payable, £10,000 in cash, and £10,000 in fully-paid shares.

An invention has just been made by Mr. John Mather, of Gateshead, by which atmospheric air rushing through a jet produces a vacuum in a small chamber or generator, into which also opens a jet from a vertical tube descending into a cistern containing the carboniferous fluid. This vacuum causes the fluid to ascend the tube, and to issue from the jet in a spray, which combines with the air rushing by. This combination is carried forward along a tube that passes through a furnace or oven, and finally conveyed in a gaseous state to the hydraulic main, and thence to store tanks.

The *Journal of the Society of Arts* says that at a recent meeting of the Chemical Society an account was read by Mr. C. Griffin, of some improvements in gas furnaces for chemical operations. The furnace, as shown and described, is in two forms, suited either for crucibles or muffles, but the principle in each case is the same, the shape being slightly modified according as the furnace was intended for use with or without a muffle. The burner consists of a circle of gas jets surrounding, with a slight intervening space, a central jet. Over this central jet an atmopyre (or small hollow clay plug pierced with holes at the side) is dropped, and on the flat top of this the crucible stands. The advantages derived from this system are that the crucible is brought into the focus of heat, and does not require any support like the trivet grate, or perforated plumbago cylinder usually employed, which are very liable to break, and are expensive.

The seventh half yearly meeting of the West of Scotland Association of Gas Managers was held on the 10th ult., when a warm discussion took place on the "Malam patent." Several of the members were o

opinion that the extraction of a larger volume of gas from a specified quantity of coal by Mr. Malam's process was only accomplished at the expense of luminosity.

Gas is being manufactured from peat at the Lews paraffine works, Invernessshire, by Mr. Caunter and Mr. Wight, for which they claim superior illuminating power. The directors of the gas company placed the town gas works at their disposal, so as to test its merits on a practical scale, and the result was a perfect success.

The gross receipts for the year of the Glasgow gas works amounted to £378,392 13s. 4d., and the expenditure, including a sum of £15,994 transferred to a depreciation-fund, amounted to £291,147 6s. 1 d., showing a gross profit £87,245 7s. 3d.

Dr. Whitmore, in his annual report for 1874 on the gas supply of Marylebone, says the mean illuminating power of the gas supplied by the Imperial Company, which lights nearly all the parish, was, for the whole year, when consumed at the rate of 5 cubic feet per hour, through a 24-hole standard Argand burner, equal to the intensity of light given by 16 sperm candles of six to the pound, consumed at the rate of 120 grains per hour each candle. It ranged between a monthly mean of 16·45 and 15·53.

The Wolverhampton Gas Company reports receipts for the last half-year as £22,723 1s. 3d., and its expenditure as £19,310 17s. 9d.; thus leaving a balance of £3,382 3s. 8d.

At Ilkeston, Derby, a memorial signed by 156 consumers has been presented to the local board, complaining of the quality of the gas, its high price, and the deficiency of the supply; and suggesting that the board should purchase the works, or take other steps to ensure better gas, more of it, and at a cheaper rate.

The Barking Local Board have determined to try the experiment of lighting the town with mineral oil, the cost of which, it is stated, will be less than half that of gas.

The formalities connected with the transfer of the Birmingham Gas-Light and Coke Co. to the corporation were duly completed on the 1st. The chief of them was the payment of the purchase-money—£450,000.

Mr. Thomas Brushfield, who since 1873, has filled the chair of the Commercial Gas Co., expired at his residence Spitalfields, on the 1st ult. The deceased gentleman was a J. P., Deputy-Lieutenant of the Tower Hamlets, and member of the Metropolitan Board of Works for the Whitechapel District. He was in the 78th year of his age.

According to Mr. Scott, the Chamberlain, the cost of gas at the Mansion House, London, during 1874, was £434 12s. 6d. On Lord Mayor's day £200 was "contributed" to meet the expense of the same commodity. For public lights, the Commissioners of Sewers paid, during the time in question, £16,357 9s. 9d. This was exclusive of about £1206 for a number of incidental expenses.

General.

Dr. Redner calculates that for every cubic meter of gas recorded as having passed through a wet gas meter, twenty-three litres of aqueous vapor or two-thirds per cent. by volume of the gas so recorded is aqueous vapor taken up by the passage of the gas through the water.

Oxygen gas when inclosed in a thin glass tube, will show itself under the action of a magnet to be paramagnetic, inclining north and south like iron; and while nitrogen, hydrogen and carbonic acids remain unaffected, phosphorus, leather and wood show themselves to be diamagnetic, and arrange themselves equatorially from east to west.

An attempt is being made in South America by a meat preserving company, to light up their premises with gas made from the bones of the animals they slaughter.

Chemical and Scientific Repertory.

The ammoniacal solution of oxide of nickel will dissolve silk; that of copper dissolves cotton also.

Pounded alum will purify water. One teaspoonful of alum to four gallons of water will cause a precipitation of the impurities.

Equal weights of acetate of lime and of chloride of calcium, dissolved in twice their weight of hot water, is a fireproofing mixture for fabrics.

A new hygrometer consists of strips of paper dipped in a cobalt salt solution containing common salt and gum arabic. In dry weather it is blue, and in wet rose red.

New Planets.—During the month of June last, three new planets were discovered, two by Prof. C. H. Peters, Nos. 144 and 145, respectively of the 11th and 12th magnitude; and one by M. Borelly, at Marseilles, No. 446, 11th magnitude.

The results of the experiments for testing the proportion of carbonic acid in the air, made during the first ascension of the Zenith, show that, at the altitude of 2,260 feet, the volumes of carbonic acid contained in 10,000 volumes of air are 2·40; at 3,200 feet, 3·00.

Coraline.—From a recent study of coraline, Commaile concludes: 1st. That it is obtained at temperatures from 239° to 302°, the product being larger and the process more rapid at the lower temperature. 2nd. The quantity of oxalic acid required is not as large as generally stated. 3rd. Coraline forms no definite salts, but only lakes. 4th. Yellow coraline is no acid, and rosolic acid is consequently a misnomer. 5th. Red coraline is no acid of the yellow, since it contains no nitrogen.

Production of Electric Light.—The invention of Mr. S. A. Kosloff, of St. Petersburgh, consists in placing the carbons on insulators, introducing the metal wire into the carbon, and connecting it by hinges of metal; producing the nitrogen gas by rarifying the air in the globe by means of the lighted carbons, and letting the heatad air escape; filling up the space in globe, and using an automatic mechanism for the passage of the electric current from one carbon to the other in case of breakage of one of the carbons.

Chloral as an Anæsthetic.—Hydrate of chloral, administered hypodermically, has recently been used as an anæsthetic with success, in the hospital at Bordeau, France. The operation was a resection of the internal and external nasal nerve, involving some fifteen minutes' work and, necessarily, excessive pain to the patient. The drug took effect in eight minutes, and complete insensibility on the part of the sufferer resulted.

Electric science occupies a place of no mean importance in the new opera house in Paris. A special room is set apart as a battery room, in which 360 Bunsen's cells, arranged in sets of 60 on rough plate glass tables, are manipulated to pass a current to any part of the stage, so as to direct the electric light upon any point of the scenery. The sunlight and startling effects produced by French scenists are really beautiful. The rainbow in the opera of "Moses in Egypt" is wonderful.

MM. Robin and Legros, experimenting with *noctiluca*, the little organisms which produce in great part the phosphorescence of the sea, found that on passing an electric current through some sea-water in the dark, its course was marked by a luminous trace, the phosphorescence of the animals being excited by the electricity.

Dr. Carpenter is inclined to believe that a purely vegetable diet, if it contains a due proportion of oleaginous matter, is capable of maintaining the physical powers of the body at their highest natural elevation, even under exposure to the extreme of cold.

Cement for Marble and Alabaster.—Mix 12 parts of Portland cement, 6 parts of slaked lime, 6 parts of fine sand, and 1 part of infusorial earth, and make up into a thick paste with silicate of soda. The object to be cemented does not require to be heated. It sets in twenty-four hours, and the fracture cannot be readily found.

Oxygen an Antidote for Phosphorus Poisoning.—MM. Threinesse and Casse have found that injections of oxygen into the veins neutralize the toxic effect of phosphorus. The gas must be pure, and free from all admixture with air, and must be introduced very slowly. The precise apparatus used is not described; and it appears that the quantity of gas required is very large, several cubic feet being administered to an animal weighing twenty pounds. The results, however, were in every way successful.

Chemical Filter.—Place inside of the glass funnel used a small filter of parchment paper pierced at the bottom with a fine needle: afterwards place the ordinary filter in the funnel, and filter as usual. Such cones of parchment paper can be used in any required size, are easily obtained, and may be applied to almost all purposes where the more expensive platinum cones have hitherto been used.

To Preserve Metallic Sodium.—According to Bottger, if sodium be placed in alcohol until its surface becomes brilliant, and then in naphthalic ether chemically pure, and finally in a concentrated solution of naphthaline in naphthalic ether, the metal may be preserved unalterable with its lustre unimpaired for a long time.

Velocity of Light.—Prof. Cornu, of the *Ecole Polytechnique*, Paris, has put into successful use a new instrument for measuring the velocity of light between two stations, in which an electrical registering apparatus is used, giving, it is believed, more accurate measurements than the well known toothed wheel arrangement of Fizeau. Foucault fixed the velocity of light, by his instrument, at 185,157 miles per second. Prof. Cornu, by his new instrument, fixes the velocity of light at 186,660 miles per second, or 1,503 miles faster per second than Foucault.

Uninflammable Products.—It is well known that certain substances, notably phosphate of ammonia, incorporated in the fibers of tissues render the same incombustible, or, rather, admit of their burning very slowly and carbonizing with the production of flame. M. L'Abbe Mauran, says *La Nature*, has recently discovered that a mixture of borax, sulphate of soda, and boracic acid, in suitable proportions, while rendering cloth uninflammable, will also prevent any alteration of color, flexibility, or lasting qualities through the effect of combustion.

Solvent of Salicylic Acid.—Though this acid is scarcely soluble in water alone, it may readily be dissolved in water containing one part of the acid to three parts of phosphate of soda. The taste is not quite pleasant, but it may be improved by using some one of the agreeable syrups, such as orange peel or wild-cherry. Alcohol and glycerine can also be employed to effect a solution, but they are not desirable for ordinary uses. Fifty parts of warm glycerine will hold in solution when cold one part of acid; three hundred parts of water to dilute may be added without causing a precipitation.

Copper Alloy that will Adhere to Glass.—The following alloy of copper will attach itself firmly to surfaces of metal, glass, or porcelain: Twenty to thirty parts of finely blended copper (made by reduc-

tion of oxide of copper with hydrogen or precipitation from solution of its sulphate with zinc) are made into a paste with oil of vitriol. To this seventy parts of mercury are added and well triturated. The acid is then washed out with boiling water and the compound allowed to cool. In ten or twelve hours it becomes sufficiently hard to receive a brilliant polish, and to scratch the surface of the gold. When heated it is plastic, but does not contract on cooling.

A New Cement.—A French chemist is said to have succeeded in preparing a mineral compound, which is said to be superior to hydraulic lime for uniting stone and resisting the action of water. It becomes as hard as stone, is unchangeable by the air, and is proof against the action of acids. It is made by mixing together 19 lbs. sulphur and 42 lbs. pulverized stoneware and glass; this mixture is exposed to a gentle heat, which melts the sulphur, and then the mass is stirred until it becomes thoroughly homogeneous, when it is run into moulds and allowed to cool. It melts at about 248° F. and may be re-employed without loss of any of its qualities, whenever it is desirable to change the form of an apparatus, by melting at a gentle heat, and operating as with asphalte. At 230° F. it becomes as hard as stone, and preserves its solidity in boiling water.

Earthquake Investigations.—Father Bertelli, an Italian monk, for several years past has made a study of the tremblings of the earth, and more especially those which are so extremely slight as not to be perceptible save by pendulums placed in the fields of microscopes. In one year he recognized 5,600 of these movements; and graphically representing the same over many years by a curve, he finds that the line corresponds neither with the thermometric curve, nor with the tidal phenomena, nor can it be brought into any relation with the distances or positions of the sun or moon. With the barometric curve, however, it is otherwise; and it appears that, in the large majority of cases, the intensity of the movements augmented with the lowering of the barometric column as if (as the investigator states) the gaseous masses imprisoned in the superficial layers of the earth escaped more easily when the weight of the atmosphere diminished.

Mineral and Mechanical Record.

Tin can be removed from copper vessels very thoroughly by immersing the objects in a solution of blue vitriol.

The evaporative efficiency of American anthracite and American bituminous coals is in the proportion of 8·9 to 9·9.

Round steel wire rope will bear more than double the weight required to break iron rope of similar diameter.

An obdurate screw may sometimes be drawn by applying a piece of red hot iron to the head for a minute or two, and immediately using the screw-driver.

Iron may be cemented in wood by dropping in the recess prepared in the latter a small quantity of strong solution of sal-ammoniac. This causes the iron to rust, rendering it very difficult to extract.

In calculating the strength of iron columns, the safe plan is to find the diameter of a solid column necessary to bear the compression, and then distribute the same area of metal in tube form or a hollow column.

Economic Use of Coal.—One and two-thirds lbs. of coal per horse power, per hour, is the consumption of fuel shown by the steamship *Plover*, a new boat built at Sunderland, England. She has compound engines indicating 562-horse power.

The following rule for strength of iron pipes is based upon the fact that a 10-inch pipe, one inch thick, will stand the pressure of 100 yards head of water. The coincidence of one inch of metal to every 10 inches diameter and 100 yards pressure should be remembered. For every inch in the diameter of pipe, increase or deduct one-tenth of an inch, and for every yard of pressure, increase or deduct one-hundreth of an inch.

Mineral Resources of New Zealand.—The province of Otago has been very carefully prospected by Mr. George H. F. Ulrich, F.G.S. The yield of gold has not been large, but the deposits appear well worth development, especially considering the prospect of improvement in depth. At Moke Creek good deposits of copper exist, and are estimated to average 12 per cent. Antimony and cinnabar have been found in the Province, but they do not appear to be worth working. There are abundant deposits of brown and pitch coal, the working of which would be highly advantageous to the Province.

Mineral Production of Europe for 1874.—The Austrian statistician Brachelli reckons the total production of minerals in all the countries of Europe for 1874 to have been as follows: Platinum, 1025 kilogs gold, 6900 kilogs; silver, 300,000 kilogs; pig iron, 240,000,000 cwt.; copper, 600,000 cwt.; lead, 5,300,000 cwt.; zinc, 2·7 to three million cwt.; tin, 205,000 cwt.; coal, 4,376,000,000 cwt.; salt, 95 to 100,000,000 cwt.; manganese, 1,616,000 cwt.; antimony, 5700 cwt.

Aluminum.—According to Winkler there are at present four aluminum manufactories, which produce about 35 cwt. per annum. Of this quantity 20 cwt. goes to France and 15 to England. Aluminum is also made in Berlin. The price for a number of years has been $12 to $15 per lb. It is not probable that it will be produced cheaper than that. This fact, with its unchangeability and lightness, being three times lighter than copper, four times lighter than silver, and 7 or 8 times lighter than gold, render it excellently adapted to coin, especially as it is easily coined.

New Process for Smelting Iron.—Some important experiments, says the *Ironmonger*, have been recently conducted at the Elsecar, English iron works, of Messrs. D. H. & Geo. Dawes, the object being the trial of a new process for the smelting of iron. The experiments have, so far, been most satisfactory, and when they are completed we hope to give a detailed account of them. In the meantime, suffice it to say that the principle now being tried will, if finally successful, cause, perhaps, the greatest revolution which has ever been made in the iron trade.

Iron in Railway Bridges.—Mr. W. Kent, of the Stevens Institute of Technology, has made some analyses of the rapid corrosion of iron in railway bridges. It has frequently been noticed that iron, exposed to the smoke, steam, and heated gases escaping from passing locomotives, shows a greater tendency to corrode than iron in situations not so exposed. A qualitative chemical analysis of iron rust that was taken from a bridge on the Pennsylvania Railroad showed the presence (in a water solution of the rust) of iron, ammonia, sulphuric acid, and traces of sulphurous acid and chlorine. A separate portion of the rust was tested for carbonic acid, which was found in considerable quantities. The escaping gases from the locomotive contain carbonic acid, carbonic oxide, moisture, and, if there is sulphur in the coal, sulphurous and sulphuric acid. The presence of these acids, no matter in how small quantity, is sufficient to promote rapid corrosion.

New Inoxidizable White Metal.—According to M. Marlie, an inoxidizable white metal may be made of iron 10 parts, nickel 35 parts, brass 25 parts, tin 20 parts, and zinc 10 parts. The alloy is cast and cut in pieces, and the latter are tempered at white heat in a mixture of sulphuric acid 60 parts, 1 nitric acid ten parts, muriatic acid 5 parts, and water 25 parts.

A New Coal Machine.—An innovation in the shape of a new coal machine, the invention of Dr. J. R. Hayes, for pressing coal dust into fuel, has been put in operation at Harrisburg, Pa. A ton of coal is reported to have been made by it in six minutes. This is stated to have been the first succesful effort made in this country for the utilization of coal-dust on a large scale.

Testing Tinned Plates for Lead.—M. Fordas recently communicated to the French Academy of Sciences the following simple method of determining the presence of lead in tinned vessels employed for packing articles of food. The metal to be tested is first touched with nitric acid, and then heated, when the acid evaporates. If lead be contained, stannic acid and nitrate of lead remain. Iodide of potassium is then applied, forming yellow iodide of lead; while the stannic acid is white. The yellow stain, therefore, indicates lead, the white, tin.

Removing Scale from Iron.—In the manufacture of some kinds of iron ware, it becomes wholly or partially covered with scale of oxide which must be removed before it undergoes further treatment, such, for example, as tinning. The best thing for this purpose, says Dr. R. Kaiser, is a 2 per cent. solution of acid sulphate of potash, in which the article may be laid. In a short time the oxide is all dissolved off, while the metal itself is scarcely attacked, which is not the case with ordinary dilute sulphuric acid.

It is said that iron goods treated as below described, acquire a bright surface, having a white glance without undergoing any of the usual polishing operations. When taken from the forge or rolls, the articles are placed in dilute sulphuric acid (1 to 20) for an hour; they are then washed clean in water, dried with sawdust, dipped for a second or so in nitrous acid, washed and dried as before, and finally rubbed clean.

Cost of the Conveyance of Coal.

The following figures have recently been published, and as furnishing an idea of the expense incurred in the conveyance of coal to the Atlantic seaboard, they deserve attention:

West Virginia gas coal (Fairmount 302 miles, Clarksburg 301 miles) to Baltimore $4·75 per ton of 2,000 lbs. Drawback allowed on shipments to Eastern ports, $1·30 per ton.

Pennsylvania gas coal from Irwin or Penn Station to West Philadelphia say 332 miles. In cars of Pennsylvania Railroad Company per 2,000 lbs., $4·75

West Virginia [Kanawha] via. Ches. and Ohio railroad, to Richmond say 350 miles, 1 cent per 2,240 lbs. per mile, (from Hawk's Nest $3·25,) on bituminous or splint, and $5 on cannel.

Broad Top semi-bituminous, to Philadelphia, say 242 miles, $3·30 per net tun, with a drawback of 75 cents, making toll on New York and Eastern shipments equal to $2 90 per gross ton

George's Creek from the mines to Cumberland, 3 cents per ton per mile.

George's Creek from Cumberland, Md., to Baltimore 178 miles: $2·05 per 2,000 lbs., and four cents per gross ton for use of cars; from Piedmont 206 miles, $2·40 cents per 2,000 lbs.

George's Creek, by C. & O. Canal, from Cumberland to Georgetown, 184 miles, $1·78 per ton of 2,240 lbs., to Alexandria, Va., 191 miles, $1·89 per ton of 2,240 lbs.

From Pennsylvania State line to South Amboy, New Jersey, for shipment, $3·25 per 2,000 lbs.

Clearfield, Pa., bituminous, from Osceola, and other stations on the Tyrone and Clearfield branch of the Pennsylvania Railroad, to Philadelphia, say 248 miles, 3·05 per 2,000 lbs.; to South Amboy, 317 miles, $4·03 per 2,000 lbs., (and six cents per ton for branch road freight) less drawback, according to location of the collieries.

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

Naphtha Gas.

New York, September 20, 1875.

Mr. Editor: The spirit of progress manifested in your issue of the 16th ult. deserves general response; more especially from those of the profession who have devoted a portion of their time to study, and have made use of their official positions to utilize meritorious inventions.

In this connection it is expected that many contributions to the general fund of information will be made at the meeting of the engineers on the 20th inst., when the record of substantial progress during the past year will be the subject of general discussion.

It has been suggested that an additional value could be given to the proceedings of the convention, if an invitation should be extended to *inventors* to be present at the meeting, with privilege of personal explanation, in detail, of the methods and apparatus used, both as to construction and application; verifying the practical working and results obtained during the past year, by the official certificate of the company at whose works the invention had been adopted.

In order to gain the earliest reliable information, the convention would do well to guarantee all such inventions, when thus exhibited to them, against any evasion or infringement by any of its members, for the purpose of giving encouragement and *protection* when needed.

Special attention has been given during the past four or five years, by several of our most prominent gas engineers, to perfect a process, and to simplify the apparatus, by which a *fixed gas* could be obtained from petroleum or its distillates, that would be commercially valuable, without requiring the admixture of atmospheric air or coal-gas; free from undecomposed vapors and having a brilliant and smokeless combustion from ordinary coal-gas burners. It is to be hoped that the result of their labors will be the introduction of an unexceptionable method for converting petroleum and naphtha into fixed gas, without loss from residuum, by an inexpensive, easily managed, simple, and safe apparatus, that will be equally desirable for the larger as well as for the smaller gas works.

If crude petroleum flowing from the earth, free from the mineral impurities that detract from the value of bituminous coals, can be thus utilized, the cost and danger of purification will also be avoided. *The greatest competition* in the business of furnishing artificial light, has been created by the use of kerosene oil at the low price at which it has been put in the market; and this has been further stimulated by the successful introduction of the *smokeless and chimneyless burner*, uniting safety and economy, and ensuring a brilliant light at a very low cost.

By the production of kerosene, however, the gas manufacturer is enabled to get petroleum naphtha at less than the cost of distillation, and therefore *if it can be properly utilized*, the means are placed at his disposal to successfully compete with kerosene oil; the desideratum being an uniform quality of brilliant gas, at about one half the present cost of coal-gas.

Among the many inventions that have been devised for such purpose, the most novel apparatus appears to be that of Mr. Spice of Wormwood Scrubbs, England. In his communication to the British Association of Engineers, published in the *Journal of Gas-Lighting* July 1, 1875, he claims that he has successfully carburetted hydrogen gas with petroleum, and obtained a product that maintained its candle power in the holder with less loss of illuminating power than gas from bituminous coals, while the cost is declared by him not to exceed 1s. 6d. sterling per 1000 cubic feet, or about one third the mean average cost of coal gas in the metropolitan companies; all such attempts, however, with us, have failed to advantageously utilize the undecomposed vapors of petroleum, by carburetting air or coal-gas; and even when partly decomposed, the general result has not been materially improved.

If it should be satisfactorily shown that the naphtha of petroleum could be entirely and *naturally evaporated* and converted into commercial gas at a similar cost, say, *not exceeding 50 cents per 1000 cubic feet*, and, by use of gas works of *one quarter the present size and cost*, it could not be expected that the large gas-light companies would immediately substitute the use of naphtha for bituminous coals, no matter how apparent the general benefit might be: for there are too many interests combined against it.

The most important of these are the coal interests, and also the lessening of the consumers' bills, by reason of the increased illuminating power, and the shrinkage in receipts by the gas-light companies, and the saving to consumers of about 15 per cent. when the ordinary gas burners are used. This shrinkage being the consequence of the increased specific gravity of the petroleum gas, can of course be entirely overcome by a proportionate increased pressure.

Notwithstanding these opposing interests, however, after petroleum gas has been successfully manufactured by gas-light companies in the rural districts, at a cost of less than one half the cost of coal-gas, the cities may get the benefit of the change, leaving the petroleum and coal interests to compound their claims with each other. All improvements which reduce the cost of materials cause a large increase in the consumption of the articles used, both in old and new fields, and a lessening in the cost of gas to the consumers, will not only largely increase the sales of gas where works already exist, calling for an enlargement of the plant to meet the increased demand, but will greatly add to the number of gas works required in new places, thus incidentally increasing the business of construction. The mutual advantage of this change to gas-light companies and consumers will be more apparent after, as is suggested in Mr. Nettleton's letter in your issue of the 16th ult., some special enactment of the legislature shall have regulated the price of illuminating gas by the candle power at which it is delivered at the consumers' meter, under certificate of a State Inspector. Yours truly, S. E. M.

Phenomena of Earthquakes.

In the *Popular Science Monthly* for October there appears an article on the causes and other phenomena of earthquakes, by Prof. Lake.

THE NOISES OF EARTHQUAKES

are thus graphically described:

Great subterranean noises and reports resembling thunder. These occur more or less during all earthquakes. Father Kircher describes them as "a horrid sound resembling that of an infinite number of chariots driven fiercely forward, the wheels rattling, and the thongs of the whips cracking;" Sir Hans Sloane, in Jamaica, as "a hollow rumbling noise almost like that of thunder." At Colares, near Lisbon, in 1755, during the great earthquake, the sound is said to have been like "that of chariots, which increased till it equaled that of the roar of cannon;" and at Lisbon, "a rattling as of coaches in the street, with a frightful noise underground resembling the rumbling of distant thunder." At Madeira the same earthquake was preceded by "rumbling noises in the air like that of empty carriages, which died away like a peal of distant thunder." On the 16th of September, 1849, there was an earthquake at Burra-Burra, in South Australia, where the noise is said to have resembled the rolling of heavy carriages. The shock was followed by a flash of lightning that illumined the whole atmosphere.

THE EFFECTS OF EARTHQUAKES

are vividly portrayed by Prof. Lake:

Another feature of these phenomena is the upheaval of the ground observed during the prevalence of most earthquakes, which is one cause of the sea retiring, another being the suction of the approaching wave when the centre of the convulsion has been removed from the shore. During the great earthquake at Lisbon the bar at the mouth of the Tagus was laid bare by the upheaval, and the master of a vessel, lying in that river at the time, stated that his large anchor was thrown up from the bottom, and seemed to swim on the surface of the water. Other results of the upward movement during this catastrophe were observed elsewhere. The water in a pond at Dunstal, in Suffolk, was jerked up into the form of a pyramid. At some places the water was tossed out of the wells. At Loch Lomond a large stone was forced out of the water. Rocks were raised into the air from the bottom of the Atlantic, and on board a vessel, about 40 leagues from the island of St. Vincent in the West Indies, the anchors, which were lashed, bounced up, and the sailors thrown a foot and a half perpendicular from the deck, the ship sinking into the water immediately afterward as low as the main-chains. At Riobamba, in South America, on the 5th of January, 1797, the bodies of many of the inhabitants were thrown, by this vertical action, upon the hill of La Cullca, which is several hundred feet high, and on the opposite side of the river. During some of these convulsions in Italy, paving-stones have been tossed into the air and found with their lower sides uppermost; and, at the time of a late convulsion in South America, the rising of the ground caused the sea to retire, which returned like a wall in appearance, carrying before it inland vessels that had only a few minutes before been left dry, towns and people being overwhelmed by the resistless recoil.

The Consolidation of Coal.

The English *Engineering Journal* thus writes in reference to consolidated coal:

"The late Commission on our Coal Supplies came to a conclusion that no less than 28 millions of tons annually of our fuel resources were disintegrated in the course of extracting that subsequently raised and used for ordinary purposes of fuel. Of this vast amount a very large proportion becomes wasted owing to the comparatively limited demand that at present exists for small coal. In South Wales, and a few other parts, the slack of steam coal is manufactured into patent fuel, which is mostly shipped for locomotive or marine engine purposes abroad, but nothing—comparatively speaking—has till quite recently been accomplished towards utilising small bituminous coal by converting it into blocks suitable for domestic purposes, the reason for this being that in all practicable processes for consolidating small coal into blocks, the amount of bituminous matter employed has been so great as to make the fuel wholly unfit for domestic use. It was thought that when the farinaceous process of making fuel was first introduced, the problem had been solved, but the expense of plant and machinery required for carrying out that process entirely prevented its being introduced successfully from a commercial point of view, and a similar remark applies to the first attempts made to continue the bituminous and farinaceous processes, where baking ovens were necessary in order to expel the superfluous water from the mucilage employed.

Mr. Danvers was the first to solve the problem of how to unite the two processes in a practical manner, and this he did by greatly reducing the amount of water used to form the mucilage, by then heating the entire mixture, and finally subjecting it to very considerable pressure in a hydraulic press. Thus, whilst taking advantage of the benefits of both processes, a fuel was obtained superior to what had hitherto been produced by either at a less cost for manufacture. The next step has been entirely to do away with the use of water, the starch being entirely dissolved in a boiling mixture of pitch and tar, a small quantity of sulphate of lime being added to drive off the ammonia from the tar, and thus depriving it of the strong objectionable smell that it would otherwise impart to the fuel. This mixture, consisting of 90 lbs. of pitch, 3 gallons of tar, and 5 lbs. each of farina and sulphate of lime, is added to one ton of small coal, and the mixture is then passed through a horizontal heating and mixing trough, from which it falls into a hopper

☞ *For other reading matter see page* 128.

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SATURDAY, OCTOBER 2, 1875.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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[CIRCULAR].

THE ANNUAL MEETING OF THE AMERICAN GAS-LIGHT ASSOCIATION.

In the last number of the AMERICAN GAS-LIGHT JOURNAL (Sept. 16) mention was made of the Third Annual Meeting of the American Gas-Light Association, to be held on the 20th of this month. Headquarters for the members will be at the Hoffman House, corner of Broadway and 25th Street.

The meetings of the Association will be held at the Masonic Hall, cor. of 23d Street and Sixth Avenue.—First meeting October 20th, 10 A. M.

It is expected that the committee on "naphtha gas" will make a report. Prof. C. F. Chandler, of the Columbia College, School of Mines, will deliver a lecture before the Association. T. Littlehales, of Hamilton, Ontario, will read a paper on the subject of "Wooden Pipes for Gas Mains."

The experience of members on the use of lime prepared according to the plan of Mr. Forstall, as set forth in his most valuable paper read before the Association at the meeting in May last, will be brought before the meeting. Members who have tried Mr. Forstall's plan, with success, are requested to prepare, and present to the meeting in full detail, their way of treating the lime, so that all gas managers may share in the benefit, as it has not been a signal success with all who have attempted this plan. Let us, if possible, improve on Mr. Forstall himself.

I had intended in this issue to present to gas manufacturers reasons why they should, for their own interest and protection, become connected with the Asssociation, whether able to attend its meetings or not; but the length to which this has already spun out, precludes that; and I will close by quoting a single sentence from a recent communication made to the English *Journal of Gas-Lighting*, by that eminent and practical gas manager—George Anderson. Speaking of the "preparation of lime for purification," he says:

"The attention which the above subject is now receiving, both in this country and in America, proves that there is no matter connected with our profession, however simple, but may be improved by ventilation and comparison of notes."

CHAS. NETTLETON, Secretary.

EMPIRICISM IN GAS-MAKING.

It is not in any degree surprising that even in gas-making there should be a certain amount of empiricism. Almost every profession has to suffer the annoyance of quackery and quacks. In proportion as an article is proved to be necessary and useful, it is sure to be counterfeited or imitated; and sometimes through ignorance, on the one hand, and impudence on the other, the sham takes precedence of the reality. It is lawful and wise to encourage experimental enquiry, both with regard to the principles of science, and the methods of their application. By such investigations new principles are evolved, or old truths illustrated; and in the absence of speculation and experiment, based upon rational laws, and conducted in a sober spirit, there would be but small prospect of unravelling the secrets of nature, or fulfilling the great purposes of life.

In the origin and manufacture of gas there is a striking confirmation of this idea. It has been by repeated experiments, and through gradual processes, that the present advanced knowledge of the component elements of gas, and of the methods of its manufacture and use, has been attained. The standard of perfection, however, has obviously not been reached; there are yet occult principles to be elucidated, and novel applications to be made; and it would be as unwise to depreciate experiments in either the theory or practise of gas manufacture as it would be to discourage the researches of the natural philosopher, or attempt to check the experimental analyses of the chemist or physiologist. A boundless field of enquiry is opening up before the human mind, in the undeveloped and hidden resources of the material world; and to all appearance we are standing now upon the brink of discoveries and truths which may throw into the shade some of the most brilliant achievements of the past. It is not, therefore, unreasonable to assume that even in the manufacture and use of gas, improvements may be suggested which were never anticipated by our ancestors, and which may go far to revolutionize our present methods of procedure. We cannot withstand the spirit of enquiry. It is useless to look with jealousy upon any new experiment or novel theory. The light of genius will penetrate the dark recesses of nature; the innate power of science will reign supreme over prejudice and tradition; and it may yet appear that gas manufactured from water, or oil, or peat, or bones, or rubbish, or any other of the multitudinous substances which are now being forced into requisition for this purpose, has qualities to recommend it to attention and use, if it does not supersede the gas now ordinarily extracted from coal.

But whether or not there be a rational probability of this, it is certain that in different parts of the world very elaborate and expensive experiments are being conducted with these things, and, as may be expected, with varying degrees of success. As the pages of this Journal can testify, water and petroleum gas has claimed, and still commands a large share of attention from practical and scientific gas men amongst ourselves; whilst now, from foreign conntries—from Canada, Great Britain, France, and other places on both the European and American continents—reports are constantly appearing of important discoveries or successful experiments, in the use of other materials. It is not our present intention to enter into a discussion of the merits of any of these theories. In some of them there may be nothing more than an empirical spirit, or idea, which has no scientific basis on which to rest, and can result in no practical advantage to the community. As at present understood, it seems the very essence of empiricism, and the most preposterous of all fancies to think of eliminating gas from the fat of bones, or from the common manure of the field. The former, however, has been attempted in South America, and the latter in several German towns.

We hardly need the assurance that in each case the experiment is practically a failure, since, although a certain kind and quantity of light may be generated, it is neither pure nor plentiful; and, contrary to the expectations of the promoters of the schemes, involves much more expense in its manufacture than the ordinary coal gas. Such is the testimony adduced by those who have chemically analysed the subject, and who are, therefore, competent to decide.

Yet even these experiments indicate a spirit of enquiry and research which may lead to the apprehension of other principles and methods more scientifically sound and practically useful; and much as we may dissent from them in theory, or confident as we may feel that they can never attain to general use and permanent success, still they are not unworthy of recognition as evidences of scientific advancement, and of chemical and mechanical skill. It is the spirit of true

philosophy, no less than the dictate of common sense, to receive whatever is good and true, irrespective of the source whence it may spring; and with a system based upon the most correct principles which science has yet evolved, and with an apparatus for carrying that system into practical effect, as complete as the present state of mechanism and science can render it, our gas manufacturers can afford to smile encouragement upon new efforts which are wisely conceived, and well directed, whilst they are laudably anxious to protect their own interests, to retain their own supremacy, and to advance their own resources and profits.

COAL CONSUMPTION AND SUPPLY.

For several years past serious attention has been devoted to the consumption and supply of coal in both Great Britain and America. It is not long since the people of the former country were startled by the announcement that within a comparatively short time their immense coal beds would become exhausted, and that in the absence of some new kind of fuel, of the introduction of which there seemed little prospect, desolation and decay would creep upon the land in sure and revolting forms. At the annual meeting of the British Association for the Advancement of Science held in 1863, Sir W. Armstrong, president for the year, enunciated the theory that the produce of coal was then advancing by a uniform annual rate of 2 and ¾ millions of tons; and that should such an average increase in the consumption continue, the coal beds would be worked out in about 212 years. A feeling bordering upon panic followed this announcement. The data of Sir W. Armstrong have, however, been controverted, and many of his conclusions pronounced unsound. According to his hypothesis, for example, the production of coal in the year 1873—ten years from the date of his prophecy—should have been about 119,000,000 tons, whereas it actually amounted to 127,000,000 tons; thus showing an increase of 41,000,000 tons instead of only 33,000,000.

At the recent meeting of the British Association held in Bristol, the subject was again brought under discussion in a paper read by Professor Jevons. The investigations and experience of the last few years have disclosed new facts, and laid the basis for more accurate estimates, if not for more positive conclusions. Yet with all the advantages thus gained it is difficult, if not impossible, to determine with mathematical precision either the extent of production, or the limit of supply. In a very valuable work on the English coal fields, Professor Hull questions the possibility of those fields yielding at any time, and with the utmost strain, more than 100,000,000 tons per year; and at this rate of consumption, he estimates their probable duration at about 800 years. The statistics, however, recently furnished show that in 1873 the production amounted to 127,000,000 tons, thus exceeding Professor Hull's calculation by 27,000,000 tons; while his estimate of the period of supply allows at least 600 years more than the hypothesis of Sir W. Armstrong.

According to Professor Jevons, the true law of increase in geometrical proportion may be taken at about three and a-half per cent.; and despite an extraordinary rise in the price of coal in the years 1872–3, that law was verified with great exactitude. In the evidence recently taken by the Royal Commission, some calculations were made by Mr. Price Williams on the average consumption of coal within the country, apart from any demand for exportation. According to these figures the consumption in 1871, per head of the population, was 3·9636 tons; and this he estimated would increase within 10 years, or to 1881, to 4·4266 tons, and this again in 1891 to 4·5784 tons; and so the rate of gradual increase would be maintained until 1941 when the maximum would be attained at the figure of 4·6526 tons. All such calculations, however, are for the most part conjectural and visionary. They leave out of sight very essential elements in the case, arising from the growth or the diminution of population, and the possibility of discovering or manufacturing some new source of fuel which might lessen the strain upon the coal beds; and even whilst the calculations were being made, evidence came to hand to show their futility. The consumption of coal, for example, in 1873 was greater by about 6,000,000 tons than it should have been on the principle suggested by Mr. Williams; and whereas he supposed that the rate of increased consumption had already passed its maximum, and was on the decline, the most recent statistics show that the increase between the years 1869 and 1873 was more than double that in the interval between 1865 and 1869. In all probability the present rate of consumption is too high to be maintained; and, as suggested by Prof. Jevons, it is at least doubtful whether the nation will ever attain the maximum of consumption supposed.

On the other hand, the assurance is encouraging that the supply of the coal beds is practically unlimited, and that, therefore, all fear of national starvation is groundless. At the most moderate computation it will take from eight hundred to a thousand years to exhaust the present known and available seams. In the Geological section of the British Association reference was made to this same subject, when Mr. Handel Cossham, a colliery proprietor of large and varied experience, stated that the resources of the Somersetshire coal field were next to inexhaustible, and that at the present rate of production it will take at least 500 years to work out the coal in the area of 150,000 acres over which the bed extends. If a minute estimate were made, upon the strictest scientific principles, of the resources of other coal beds throughout the United Kingdom, a similar testimony might be educed; and apart, therefore, from all questions of an additional supply, there is little prospect that for another thousand years the famous New Zealander of Macaulay's essays will take his stand upon a broken arch of London Bridge, and sketch the ruins of St. Paul's, as the last remnant of a once mighty nation. But why should not the coal supply increase almost in an equal ratio with its consumption? Whatever may be its component elements, the formation of coal must obey the law of nature in gradual development and growth. The coal beds as they now exist have not thus been stereotyped from the original creation. During the long geological periods which preceded the actual construction of the globe, and throughout the ages which have since been marked in the history of the world, the precious minerals have been forming and maturing deep down in the bowels of the earth; and even now the mysterious process of growth and consolidation is carried on with undeviating regularity, and in obedience to a divine and inflexible law. The very coal which now serves to heat our furnaces, and to light our homes, may, reasoning upon geological data, be of comparatively modern growth; and in view of such a fact, what is to prevent the assumption that during another thousand years new coal seams will be formed, and old ones widened and thickened, until for every coming generation the supply shall be commensurate with the demand?

What is thus true of the coal-fields of Great Britain, is applicable to those of America, and every other part of the globe; and whether or not the aggregate population of the world be stationary—as many suppose—or numerically on the increase, there is small probability that the present average consumption of coal will be enlarged, or that under any circumstances the rate of increase will exceed the rule of 3½ per cent. The fears of a coal famine may therefore be dismissed, as the result of conjectural theories rather than of scientific data. At the same time there is danger that abundance of supply may lead to extravagance in use; and the people of all countries have need to be cautioned against a want of economy in their consumption of this most indispensable requisite for both trade and comfort. The gift of Providence in this respect is bounteous and rich; and we shall show our appreciation of it by its careful and judicious use.

[ADVERTISEMENT.]

Extra Large Lap-Welded Tubes and Enam eled Water Pipes.

At a recent visit to the works of the National Tube Works Company at McKeesport, Pa., we witnessed the operation of making lap-welded tubes of such a size and quality as to call for notice. The company makes these seamless tubes or pipes of any size up to *fourteen inches diameter*. And as every length is tested by hydraulic pressure before leaving the works, their strength and quality is fully guaranteed. They have been found admirably adapted to carrying water for the hydraulic mines of California, Nevada, and other Western States, and for water-works which do not require larger mains than 14 inches. The company has just completed an order for the Virginia City and Gold Hill Water Company, of Nevada, of seven miles of 10-inch pipe, the most extensive order that, we believe, has ever been given in this country. These seamless pipes, even without coating, are more durable and are also less expensive than the riveted pipes; but the company applies a patent enamel to them that, it is claimed, makes them almost indestructible, and, indeed, the company is willing to guarantee their durability for *any* length of time. The appended reports by Dr. S. Dana Hayes, Massachusetts State Assayer and Chemist, and Prof. Otto Wuth, of Pittsburgh, Pa., fully establish the claims of this pipe to durability. We commend it not only to our gas and water companies, but also to our mine owners and others who have to use or convey impure water, such, for example, as in many anthracite mines. These large pipes would make excellent screen shafts for our coal breakers, and the enamel would doubtless be of great advantage for coating the exposed ironwork about the mines.

In bringing the matter to the consideration of "those whom it may concern," we believe we are doing consumers as well as manufacturers a service.

REPORTS.

"I have recently made a series of tests of your enameled pipe, for the purpose of ascertaining its value as a service pipe for conveying water and other fluids, and now submit the following report of the results obtained:

"Portions of the enamel covering itself were first removed from several pieces and submitted to chemical analysis, to determine the presence of deleterious substances; but the results of these analyses are entirely negative, as there is nothing of this kind present. The pipe is made of wrought iron, covered inside and outside with an elastic, enamel-like material that does not contain any unwholesome or objectionable ingredients.

"Its durability was then tested, by exposing different pieces of the pipe to the solvent action of hard, soft, and sea waters, alcohol, and other fluids, for many days, and finally those fluids were boiled in the pipe for several hours in each case—the object of this boiling being to obtain, as nearly as possible, in a comparatively short time, the effect produced in the pipe by long-continued usage. These tests have been very complete, and I am quite surprised at the durability and power of resistance of the enamel covering determined in this way. It has not failed in any trial with natural waters in my laboratory, and it has withstood the action of boiling corrosive fluids for a longer time than specimens of other water pipes now in common use.

"I commenced this investigation with some doubts about your enamelled pipe, but the severe tests which I have employed prove that it is perfectly harmless and possesses great durability, these being the properties of most importance in water pipe.

S. Dana Hayes,
State Assayer and Chemist, Mass.

"I have made a complete series of tests in order to ascertain the quality of your patent enameled pipe, and found that the enamel covering perfectly both the inside and the outside of the wrought iron pipe, is not in the least affected by the action of alkalies, acids, salts of any composition, alcohol—in fact, any liquids which in practice are apt to be conveyed through the pipe. The enamel itself contains no deleterious substance whatever, and even if it did it would not make any difference, as not a trace of it will become soluble. Pipe so enameled is specially adapted for water and gas. O. Wuth."

leading to one of Bodner's hydraulic brick presses, where it is subjected to a pressure of half a ton to the square inch, and is then ejected from the mould, and carried away to the stacking ground. It is ready for use within a couple of hours of being made; that is, as soon it has become cold throughout. From the time the coal is mixed with the bituminous mucilage to its removal from the press in the form of a perfect block about seven minutes are occupied, and a brick of fuel is then formed capable of standing much knocking about, and handling without anything like the waste that would be occasioned by coal under similar treatment.

Ocular Inequality.

A writer in *Science Gossip* speaks of the difficulty which some persons experience in the use of binocular microscopes, owing to a focal difference in the eyes. In a case mentioned one eye was far sighted, while the other was near sighted. For reading purposes, this person wears a pair of spectacles in which the one glass is made for the far sight, while the other is a plain glass, the left eye being near sighted, and consequently requiring no aid from spectacles with which to read. Instances are cited of persons who, while employing both eyes for ordinary vision, usually employ only one in reading.

If any difference of the kind exists between the visual powers of a pair of eyes, it may be readily detected. Hold up a piece of card before one eye, so as to cut off its field of view, and then look at some object before you with the other. Then gradually bring the card before the other eye, and view the same object. If the object is seen with the same distinctness in each case, then your eyes are perfect as regards the balance of their food; if not, then there is focal difference more or less decided. It would no doubt be advisable to take account of the very frequent difference of focus, in selecting a pair of spectacles.

NOTICE.

AMER. GAS-LIGHT ASSOCIATION

OFFICE AMERICAN GAS-LIGHT ASSOCIATION,
117 BROADWAY, N. Y. CITY.

THE THIRD ANNUAL MEETING OF THE ASSOCIATION will be held in the **CITY OF NEW YORK,** on the **20th of October, 1875,** for Election of Officers, and other business incident to the Annual meeting. All Members of the Association are earnestly requested to be present.

Every Gas Company is invited to become connected with the Association, by having one or more of its Officers, Engineers, or Superintendents, become a member.

Individual Managers of Gas Works, and all persons practically skilled in the Construction and Management of Gas Works are also invited to join the Association.

CHARLES NETTLETON, Secretary.

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☞ All communications will receive particular attention

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Gas. Co.'s of N. Y. City.				
Harlem	$1,850,000	50	133	131
Manhattan	4,000,000	50	295	300
Metropolitan	2,500,000	100	155	160
" Scrip		..	106	...
Mutual	5,000,000	100	106	—
New York	4,000,000	100	152	156
Westchester	466,000	50	100	105
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	245	250
Citizens	1,200,000	20	...	152½
" Scrip		...	101	...
Peoples	1,000,000	10	100	105
" Bonds		...	98	...
" Scrip		...	102½	...
Metropolitan	1,000,000	100	104	—
Nassau	1,000,000	25	128	...
Williamsburgh	1,000,000	50	142	...
" Scrip		...	102	...
Out of Town Gas Companies.				
Buffalo Mutual, N. Y	750,000	100	50	50
Baltimore, Md	2,000,000	100	190	...
Brockport, N. Y	25,000	...	...	90
Citizens, Newark	500,000	...	...	55
Derby of Conn	160,000	100	...	80
East Boston, Mass.		25	112	115
Hannibal, Mo	100,000	100	90	...
Hartford, Conn	700,000	25	41	43
Hempstead, L	40,000	100	...	100
Jersey City	386,000	...	160	...
Jamaica, L. I	25,000	100	...	100
Lewistown, Maine	400,000	100	...	80
Peoples, Jersey City		...	130	65
Peoples of Albany	1,000,000	100	45	...
Peoples of Baltimore		25	108	...
Rochester, N. Y		100	50	...
Fort Wayne, Ind		100	...	105
Woonsocket, R. I	150,000	100	100	...
Lima, Ohio	30,000	100	10	...

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Pictou			2 25
Block House—At Mines, $1.87, Gold			0 00
Caledonia—At Mines, $1.75, Gold			0 00
Little Glace Bay—At Mines, $1.75, Gold			2 00
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Sydney—Old Mine			3 00
" Reserve, $1.75, Gold Mine			2 25
" International			—

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Westmoreland—At Amboy	6 50	@	0 00
(In New York both the above coals $6 50)			
Shafton	6 50	@	0 00
Youghiogheny	6 50	@	0 00

West Virginia Coals.

Murphy Run	$6 50	@	0 00
Despard	6 50	@	0 00
West Fairmont	6 50	@	0 00
American Gas Coal	7 40	@	0 00
Fairmont	6 50	@	0 00
Newburgh Orrel	6 50	@	0 00
Pinnickinick	6 50	@	0 00
Cloverhill of Virginia	6 00	@	6 50
McKenzie Compound Mixture			— —

American Cannel Coals.

Peytona of West Virginia	$12 50	@	00 00
Darlington of Pennsylvania			— —
Cannelton Cannel			11 00
Red Bank—at Philadelphia			6 50
" —at South Amboy			7 25

Asphalts.

Albertite of New Brunswick	$— 00	@	— 00
Ritchie Mineral of West Virginia	18 00	at	Balt'e.
Trinidad Bitumen	— —	@	14 05

The Penn Gas Coal Company have contracted with the Pittsburgh Gas-Light Co. for their entire supply for the ensuing year from their Youghiogheny mines.

Advertisers Index.

☞ In looking for advertisements, see figures 1 to 12, within brackets, at head of advertisement pages.

GAS BURNERS, APPARATUS, ETC.

American Meter Co.—West 22nd st., N. Y., Arch and 22d st., Phil., 548 Washington st., Boston 11
Cast Iron Gas and Water Pipe—S. Decatur Smith, York and Moyer streets, Phila., Pa 8
Cast Iron Gas and Water Pipes—R. D. Wood & Co., Philadelphia Pa 10
Cast Iron Gas and Water Pipe—Jno. McNeal & Sons, Burlington, N. J 8
Franklin Foundry and Pipe Works—Jas. Marshall & Co., 23 Nineteenth street, Pittsburgh, Pa 2
Gas Valves (Chapman) 75 and 77 Kilby st., Boston, Mass 3
Gas-Burners—C. Gefrorer, 248 North 9th st., Phila., Pa 9
Gas Purification—St. John and Cartwright 5
Gas Meters, etc.—Harris, Griffin & Co., 12th and Brown streets, Phila., Pa 10
Gas Meters, etc.—Wm. W. Goodwin & Company, 1012 Filbert street, Phila, Pa 17
Gas Meter Manufacturers—Harris & Bro., 1117 Cherry st., Philadelphia, Pa 11
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway 7
Gasholders, Etc.—Delly & Fowler, 39 Laurel st., Phila., Pa 4
Gas Screen—James P. Mahon, Boston, Mass 5
Gas Engineer—Henry Cartwright, Phil. Pa 4
Lime Hurdles.—Manhattan Lime Hurdle Co., Geo. W. Day, Treas., No. 3 Railroad Square, Haverhill, Mass 2
Lava Tips and Scotch Tips—Charles H. Meyer & Co., 227 Chestnut street, Phil. Pa 8
National Tube Works Co., 78 William St., N. Y 7
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Avenue C., N. Y 4
Patent Gas Exhauster—Smith & Sayre, 95 Liberty street 4
Pelouze & Audouin Condenser—Jas. R. Smedberg, Sole Agent for U. S. San Francisco, Cal.; Henry Cartwright, 2107 Green street, Phil. Pa 1
Petroleum Gas—J. D. Patton, Treverton, Pa 4
Patent Gas Exhauster—S. S. Townsend, Agt., 31 Liberty street, N. Y 3

GAS COALS

Cannelton Coal Co. of West Virginia—J. Tatnall Lea, 325 Chestnut street, Phila, Pa 3
Despard Coal Co.—Parmelee & Bros., Agents, 32 Pine st., New York 7
Gas Coals—Bird, Perkins & Job, 27 South st., N. Y 7
Monongahela Gas Coal—56 Exchange Place, Baltimore, Md. 6
New York and Cleveland Gas Coal Company—384 Penn Avenue, Pittsburgh, Pa 6
Ohio Gas Cannel—G. Merryweather, Pine cor. Wm. sts.
Penn Gas Coal Co.—11 Merchants' Exchange, Phil. and 90 Wall street, N. Y 6
Peytona Cannel Coal—S. E. Low, 58 Broadway, N. Y 5
The Newburg Orrel Coal Co.—Chas. W. Hays, Agent in New York, Trinity Building, 111 B'way, Room 7 6
Tyrconnell Gas Coal—52 S. Gay Street, Baltimore, Md 6
Westmoreland Coal Co.—230 South 3rd Street, Phil. Pa 7
Youghiogheny Coal—Perkins & Job, 27 South St. N. Y 7

FOUNDRIES.

Atlantic Dock Iron Works—John P. Kennedy, Office 98 Liberty street, N. Y., P. O. Box 2348 8
Cast-Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md 6
Continental Works—T. F. Rowland, Greenpoint 6
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Son. 5
Gloucester Iron Works—J. P. Michellon, Sec., 6 North 7th street, Phila., Pa 4
Mill Street Foundry.—Geo. Stacey & Co., Cincinnati, O 5
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman & Wilkins streets, Pittsburg, Pa 6
Oregon Iron Foundry—Herring & Floyd, 740 Greenwich street, N. Y 10
Pascal Iron Works—Morris, Taskar & Co., Philadelphia 12
Providence Steam and Gas Pipe Co., Providence, R. I.—H. A. Branch, Agent 3

WATER METERS, PUMPS, ETC.

Cast Iron Pipes for Water and Gas—Riley A. Brick, 112 Leonard street, N. Y 10
Valves for Water, Steam and Gas—Ludlow Valve Man'g Co., 940 River street, Troy, N. Y 6
Water Pipes, etc.—S. Fulton & Co., 412 Walnut st., Phila 7

CLAY RETORT WORKS.

B. Kreischer & Son, Clay Retorts, etc., 58 Goerck st., N. Y. 8
Cheltenham Fire Brick and Clay Retort Works—Evens & Howard, 916 Market street, St. Louis, Mo 8
Manhattan Clay Retort Works, 15th st., near Av. C, N. Y. 8
Philadelphia Fire Brick Works, Vine and 23d sts., Phila 8

LAMPS, STOVES, PETROLEUM, ETC.

Lamps—M. B. Dyott, 114 South 2nd Street, Phil. Pa 1
Patent Lamp Post—J. W. Graham, Chillicothe, Ohio, or A. M. Callender, office of this Journal 9

MISCELLANEOUS.

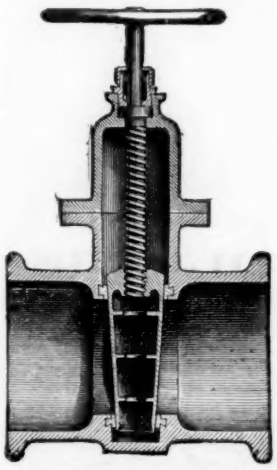
Analysis and Testing of Gas Coals—Prof. Henry Wurtz, 12 Hudson Torrace, Hoboken, N. J 10
Architect and General Gas Engineer—William Farmer, 111 Broadway Room 95, N. Y 5
Brass Cocks, Plumbers' Materials, etc., etc.—McNab & Harlin Manufacturing Co., 56 John st., N. Y 7
Cements—S. L. Merchant & Company, 76 South st., N. Y 2
Contractors for Gas Works, Etc.—Murray & Baker, Fort Wayne, Ind 2
Fodell's System of Bookeeping—A. M. Callender & Co., 42 Pine st., New York 1
Gas Engineer—B. E. Cholar, 914 Olive St., St. Louis, Mo 2
Gas-Light Company of America, 63 and 64 Drexel Building, New York 2
Kidd's Gas Consumers Guide—A. M. Callender & Co., 42 Pine Street, N. Y 6
Massachusetts Institute of Technology—Samuel Kneeland Boston, Mass 9
National Coal Gas Company—H. P. Allen, 4 Warren street New York 7
School of Mines, Columbia College, East 49th st 9
Screening Shovels—Herring & Floyd, 740 Greenwich st., New York 7
Scientific and Practical Chemist and Geologist—Profetsor Henry Wurtz, 12 Hudson Terrace, N. J 8
Screening Shovels—G. W. Dean, 1358 Broadway, N. Y 8
Springfield Gas Machine—Corner Canal and Centre St 8
Slade's Automatic Fire Governor—Jas. Slade, Gas Works, Yonkers, N. Y 8

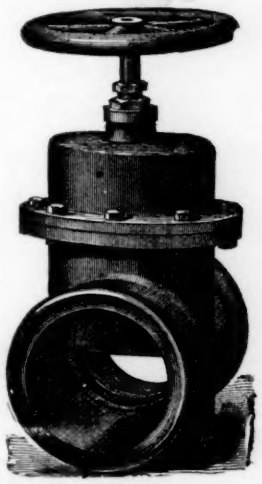
CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.





These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is NO LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.

We refer to the following named Gas-Light Companies among the many that have used these Valves:

BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.

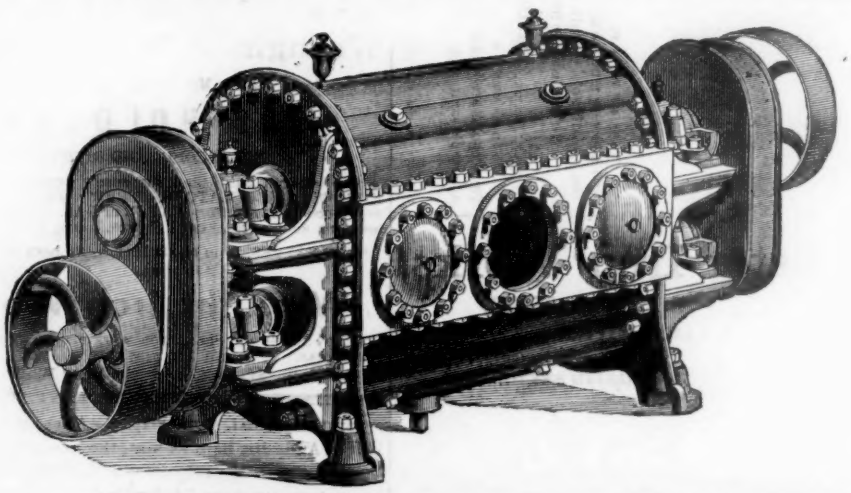
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG, MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH, N. Y.

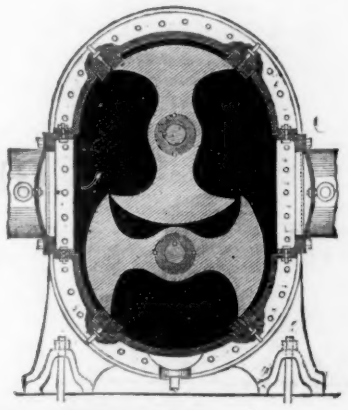
GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.

STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.

857–tf

PATENT IMPROVED GAS EXHAUSTER.





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The following are some of the advantages we claim for this Exhauster over all others:

FIRST.—It is simpler in its mechanical construction than any other Exhauster in use.

SECOND.—The internal parts consist of only two revolvers, each cast entire in one piece, without a single screw, bolt, nut, washer, key or other part to get loose on the inside and stop or break the machine. The internal operating parts, therefore, can not get out order, and hence require no care or attention.

THIRD.—Every part of the machine requiring care or attention, as the journals, gearing, etc., is external, easily observed and attended to. All changes, adjustments, and repairs are made from the outside. The journal bearings, if necessary, can be renewed in a few minutes.

FOURTH.—The internal operating parts are practically gas-tight, but are not in actual contact, hence there is no internal friction or wear. The machine is therefore operated with less power than any other.

FIFTH.—They are built in the most complete and substantial manner, with steel shafts and improved journal bearings, and their durability is almost without limit.

We build them of any required capacity, large or small, adapted to any kind of works or place.

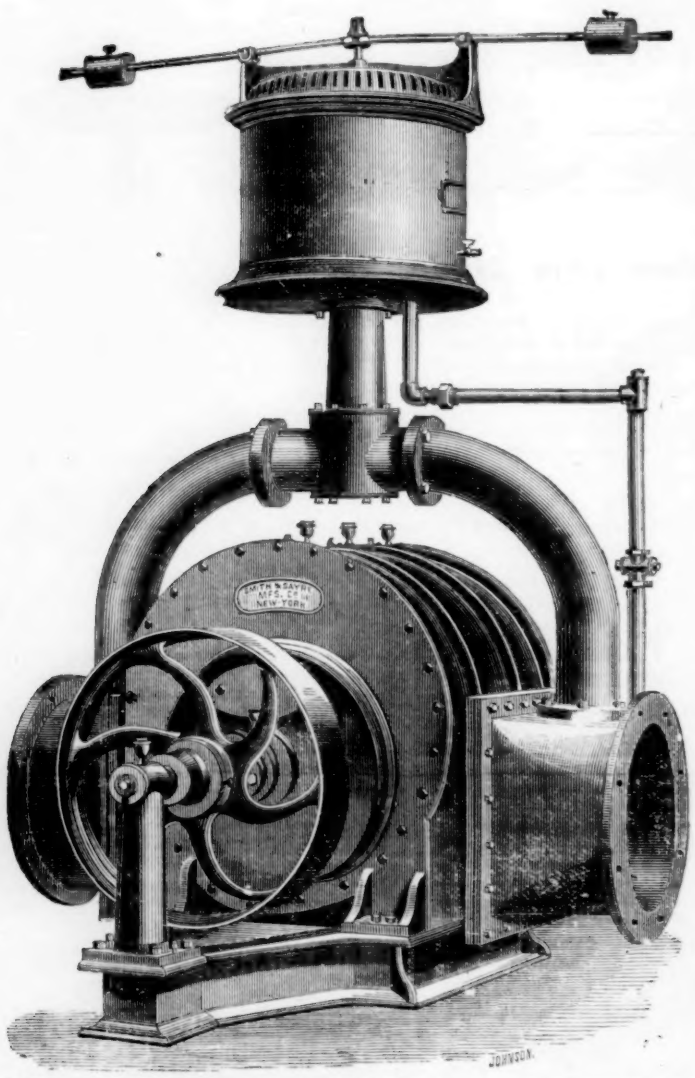
Send for Illustrated Catalogue, giving all particulars as to capacity, speed, power required, dimensions, and price of each size, and references to parties using them.

P. H. & F. M. ROOTS.

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-jo ints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan

The Cupolas are manufactured in sizes to melt from 1 to 90 tons per hour, will save one quarter of the time required by the old style Cupola and 33 per cent fuel. Address

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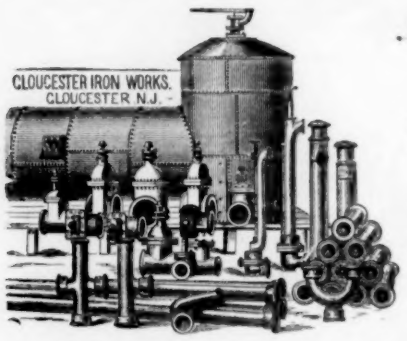
CHARLES W. ISBELL, Secretary.



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PHILADELPHIA.

DAVID S. BROWN, Pres't. JAMES P. MICHELLON. Sec'y.
BENJAMIN CHEW, Treas. WILLIAM SEXTON, Sup't.

CAST IRON GAS AND WATER PIPE.

Cast Iron Heating and Steam Pipe. Stop Valves. water or Gas.

Fire Hydrants,

GAS HOLDERS.

EVENS & HOWARD,

Manufacturers of a superior quality of

Fire-Brick, Clay Gas Retorts,

Gas Tile, Drain Pipe, Fine Ground Fire Clay, &c.

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MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superio Coke, with little Ash, and scarcely any clinker. 304-1y

T. F. ROWLAND,

Continental Works,

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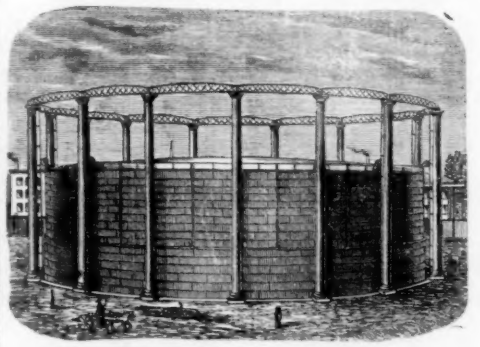

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OF ANY MAGNITUDE,

Condensers, Scrubbers, Purifiers, Retorts, Hydraulic Mains and all other articles connected with the Manufacture and Distribution of Gas, furnished with despatch. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

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Camden, New Jersey.

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ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses Retorts and all castings required for setting them in the latest and most improve model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varyin from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

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TELESCOPIC AND SINGLE,

With cast iron guide and suspension frames. GAS ERNORS or REGULATORS, STREET MAINS, from 1½ 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SIEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

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All the Smith and Sheet Iron work required in and abou Gas Works. 226-tf

JESSE W. STARR. JESSE W. STARR, JR.

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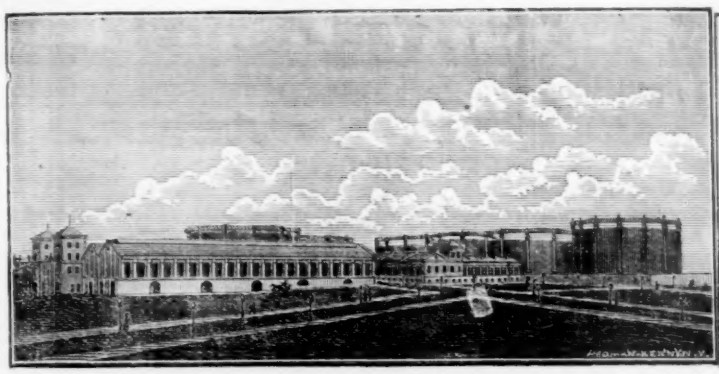
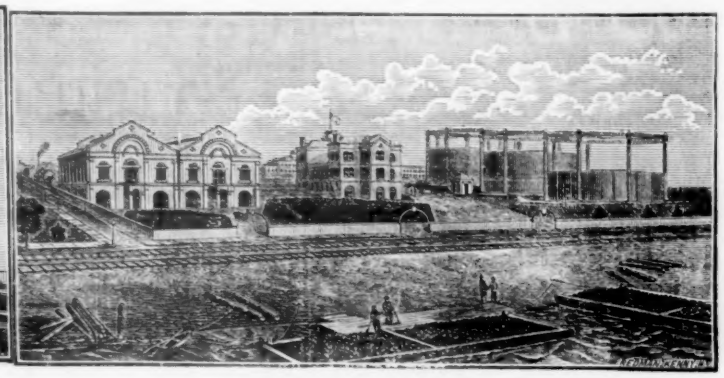


CINCINNATI GAS WORKS. ERECTED 1871-72-73.—WM FARMER, ENG.,



LACLEDE GAS WORKS, ERECTED 1872.—WM. FARMER, ENG

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ARCHITECT AND GENERAL GAS ENGINEER,

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WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

REFERENCES:

Professor SILLIMAN, New Haven, Conn.
GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
Prof. HENRY WURTZ, Editor AMERICAN GAS-LIGHT JOURNAL, N. Y.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal.

P.P. DEILY, 1842. J. FOWLER. 1875.

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Single and Telescopic.

WROUGHT IRON ROOF FRAMES,
COAL WAGONS,
COKE BARROWS,

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Wrought Iron Work

CONNECTED WITH GAS WORKS.

☞ Particular attention paid to Extensions and Repairs.

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MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

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GAS SCREEN,

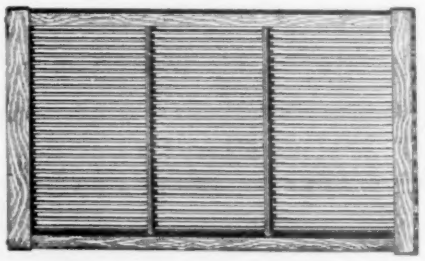
OFFICE 19 TREMONT ROW, ROOM 5,

BOSTON, MASS.

JAMES P. MAHAN, Treasurer.

Manufactory at Haverhill, Mass.

E. DUFFEE, Agent,
Formerly with AMERICAN GAS SCREEN CO.,
Haverhill, Mass.



The Screen is made with an ash or oak frame, perforated with ROUND RATTANS, turned and reeved through, drawing the frame firmly together, strengthening it *without the use of nails or rivets.*

This Screen is reversible, can be used either side up, gives a large purifying capacity; there is no clogging by foul lime, as the rattan presents a smooth surface and can be cleaned very easily. It is considered by all Gas Engineers who have used it to be the best Screen now in use.

☞ **Samples sent Free to all Parts of the United States.**

All communications should be addressed to

JAMES P. MAHAN,
19 Tremont Row, Room 5.
Boston, Mass.

384-6t

MECHANICAL & GAS ENGINEER.

To Gas-Light Co's.

The undersigned respectfully announces his voluntary resignation of the Vice-Presidency of the American Meter Company from the 1st of March last, after filling that position from its organization in 1863, and now offers his services as

Consulting or Constructing Engineer,

in the erection of new, or the extension of Gas Works.

He is prepared to furnish plans and Specifications, embracing all the latest improvements in the MANUFACTURE OF COAL GAS, at short notice, and on reasonable terms. His experience of THIRTY YEARS in the construction of Gas and Water Works, Railroads, Tunneling, etc., enables him to refer with confidence to any of the Works erected by him, as a guarantee of satisfaction and ability.

By arrangements with reliable manufacturers of all MATERIAL and SUPPLIES used by Gas Companies, he is prepared to furnish promptly all such orders, with best selections, and to give satisfaction as to prices, terms, etc., and respectfully solicits a share of patronage.

HENRY CARTWRIGHT, Gas Engineer,
2107 GREEN STREET, PHILADELPHIA. 379-6t

KIDD'S

Gas Consumers' Guide

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

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GAS COALS.

THE

PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

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PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side),
Greenwich Wharves, Delaware River.
366-1y Pier No. 1 (Lower Side), South Amboy, N. J.

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

cknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 ubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in		Sulphur in			Specif. Gravity.	
		Coal.	Coke.	Coke.	Ootl.	Volatile Matter.	Coal.	Gas.
35.1	64.9	2	6	.82	1.48	.66	1.289	.476

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb.—gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

SALES AGENTS { J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.
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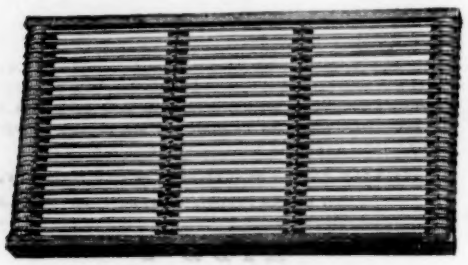
THE MANHATTAN

LIME HURDLES

after a practical trial have been adopted by over thirty Gas-Light Companies *the last season*, some of them the largest in the country.

They are LIGHT, STRONG and DURABLE, made *with Ash frame* and *round flexible Rattans.*



Shipped to all parts of the country.
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THE MANHATTAN

LIME HURDLE CO.

HAVERHILL, MASS.

J. L. Blaisdell, President.
George W. Day, Treasurer. 389

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. Oliver O'Donnell, Pres't. Chas. Mackall, Sec'y.
Chas. W. Hays, Agent in New York, Room 7, Trinity Building, 111 Broadway.
Sinclair & Agnew, Agents, Alexandria, Va.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

The best dry coals shipped, and the promptest attention given to orders. 224-1y

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

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Mines in Harrison County, West Virginia.
Wharves Locust Point, Company's Office, 29 South street, } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine.

"," Reference to them is requested. 204-1y

NEW YORK AND CLEVELAND

GAS COAL COM'Y

Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

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Branch Office—C. & P. RR. Coal Pier, CLEVELAND, OHIO.

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W. H. WATERBURY & CO., General Sales Agents,
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From West Virginia.

Yields over 13,000 feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over 43 candles. Purifies 4,510 feet to the bushel of lime.

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No. 4 Warren Street, New York.

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This Company is the owner of the GWYNNE-HARRIS, or AMERICAN HYDROCARBON process, for making Gas for Lighting or Heating purposes, by the perfect decomposition of superheated steam, under what is known as the

GWYNNE AND HARRIS PATENTS.

This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

The process can be put into either Coal or Oil Gas Works (or where both Coal and Oil are used) at small cost, without any interruption to the working of other benches. The Citizens Gas-Light Company of Brooklyn, after using it for more than seven months, have found it not only far better, but actually *cheaper* than atmospheric air in making Gas, with the use of "petroleum and its products."

Further information, and terms of sale of rights will be given, upon application to the Company 348-1y

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Roman Cement,

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Numbers 1 and 2.

From best London Manufacturers.

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ENAMELED GAS AND WATER PIPE,

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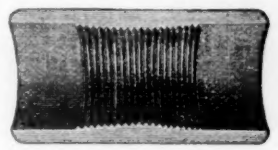

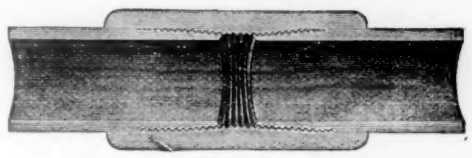

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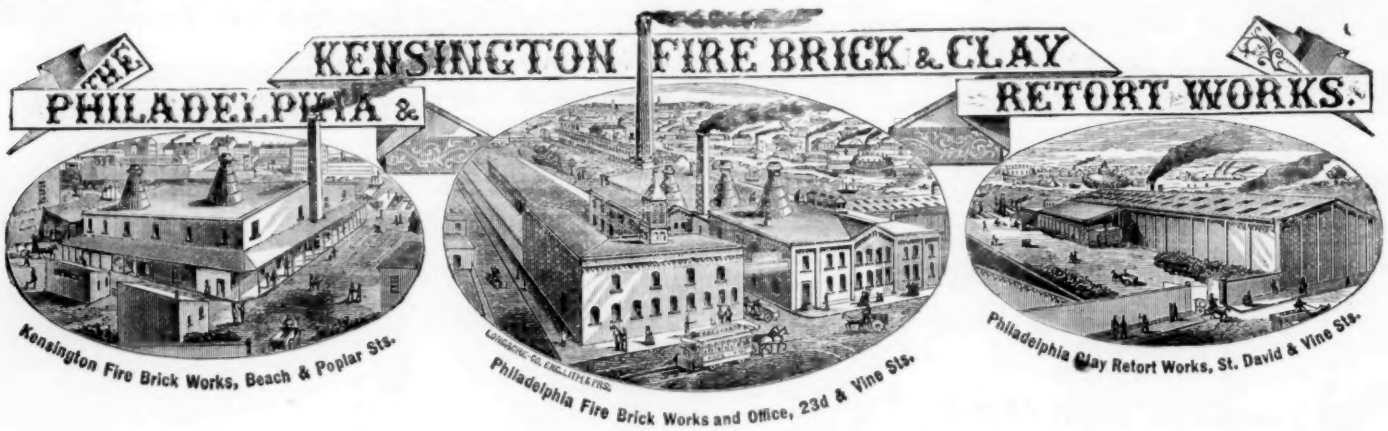
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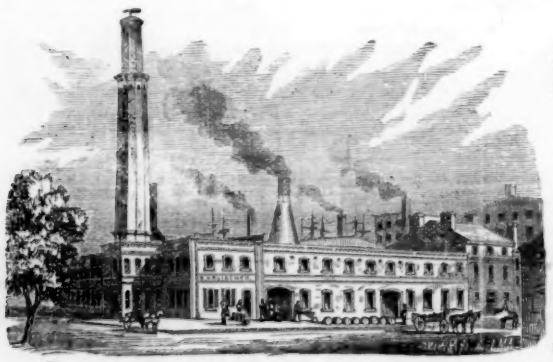

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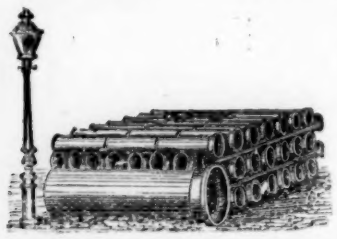

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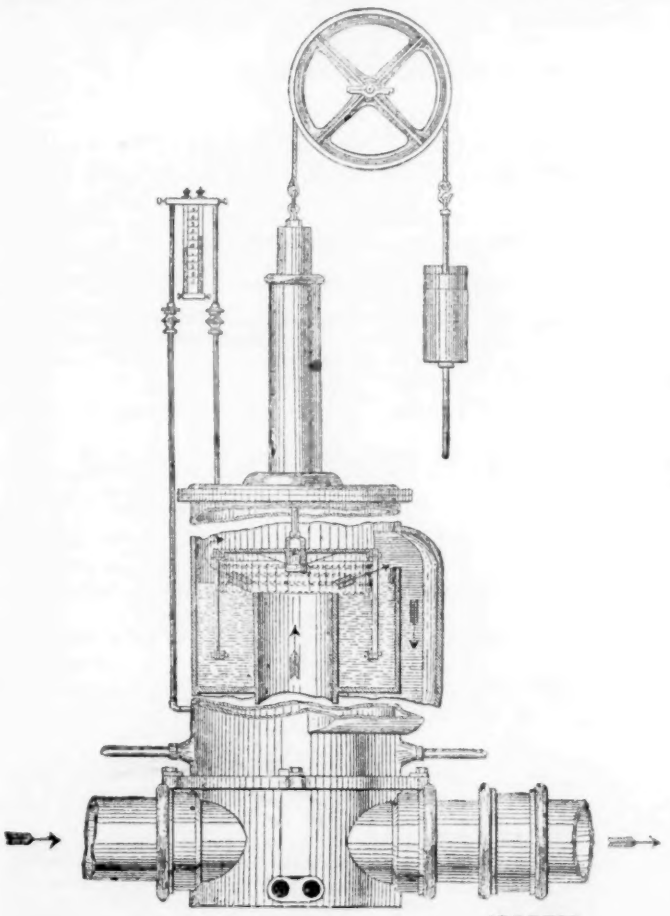

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This apparatus is based upon the recent discovery by Messrs. PELOUZE & AUDOUIN of the principle of Condensation by impact, or percussion.

All gas-makers are aware how difficult it is to separate all the Coal Tar and Water from Crude Coal Gas by mere cooling; and how frequently these liquids are swept on to the purifiers, even where scrubbers or washers of large size and considerable cost are employed.

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The Differential Gauge is so constructed that there is no oscillation of its water-columns; while it indicates inlet pressure, outer pressure, or back-pressure, at the will of the observer.

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Has purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime.* Takes out *all the ammonia.* Now operating in the following Gas Works: Harlem New York (21st street); Port Morris; Hunter's Point; East New York Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St, Albans, Vt.; Pawtucket, R. I.; Meriden, Ct., and being introduced in many other places.

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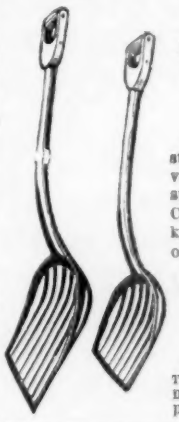

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Yours truly,
LUCAS FLATTERY
Sec'y Wooster Gas-Light Co.

Address the Patentee,
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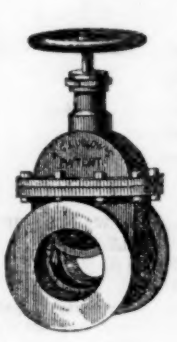

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For the Erection, Alteration and Extension of Gas Works.

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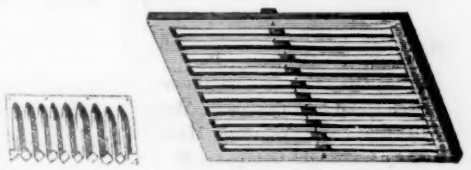

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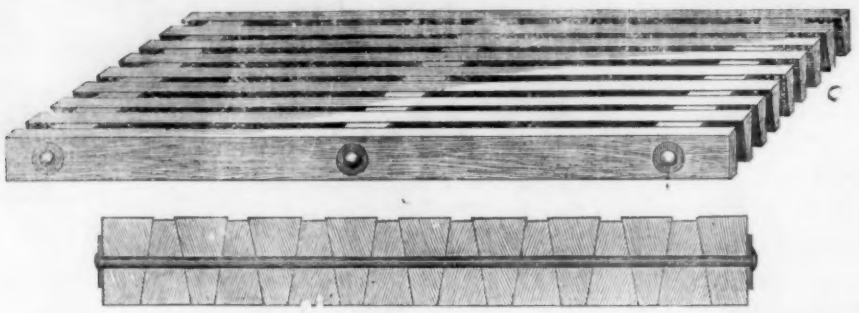

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